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SOIL SURVEY

of the

ANNAPOLIS VALLEY FRUIT GROWING AREA

by

L. C. HARLOW
Provincial Chemist, Department of Agriculture, Nova Scotia

and

G. B. WHITESIDE
Surveyor in Charge, Dominion Department of Agriculture

Experimental Farms Service, Dominion Department of Agriculture
in Co-operation with the Provincial Agricultural College,
Truro, and the Nova Scotia Department
of Agriculture

Published by authority of the Hon. James G. Gardiner,
Minister of Agriculture, Ottawa, Canada

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INTRODUCTION

Soils vary tremendously in their power to produce different crops, and this has an important bearing on the success and prosperity of the farmers in any community. A thorough knowledge of the various requirements and capabilities of soils is a great aid in the development of a prosperous agriculture. These facts are appreciated by many farmers in Nova Scotia. In order to obtain such information, a soil survey of the Annapolis Valley fruit growing area was started in 1934 at the request of the Fruit Growers' Association of Nova Scotia.

The results of this survey are presented in this report. It describes all the soils which have been mapped in the Valley, and discusses their adaptability and productivity based on the information gained in the field and laboratory. Factors which have an important bearing on the main characteristics of the soil, such as climate, geology, and vegetation, are also briefly discussed. Extensive chemical and physical data of these soils are attached in the appendix.

A soil map, prepared in three sections, on a scale of one inch to one mile, is attached to the report. It shows, in different colours and symbols, all the soils found in the area. Sufficient land marks, such as roads, railroads, rivers, elevations, houses, etc., are also shown to enable one to identify any location on the map. The map is not in sufficient detail to show all the small soil variations, which may occur in some fields of a particular farm.

The map indicates the kind of soil found at a particular location, while the report gives all available information regarding this soil. The results of this survey will also permit a farmer to compare his results with those obtained by other farmers on similar soils elsewhere. The map will assist in utilizing the information obtained from experimental work which has been conducted, by indicating, with reasonable assurance, where similar results can be expected. The information obtained in this survey should also be a valuable guide for further research and investigation, which might be undertaken in order to increase the productivity of the land and to solve other soil problems.

GENERAL DESCRIPTION OF AREA

Location and Extent

The area included in this survey consists of the lowlands extending across the northern part of Annapolis and Kings Counties from Annapolis Royal to Minas Basin, known as the Annapolis-Cornwallis Valley; the Gaspereau Valley, and that part of the Minas lowlands in the western section of Hants County lying along the north and west side of the Avon River and more generally called the Avon River Valley (Fig. 1). It lies approximately between 64° 15′ and 65° 15′ west longitude and 44° 15′ and 45° 15′ north latitude. The area is located in the northwestern section of the Province of Nova Scotia, on the south side of the Bay of Fundy.

These valleys, particularly the eastern end of the Annapolis Valley, as it is called, the Gaspereau and the Avon River Valleys, form the commercial apple growing district of Nova Scotia. The area covers approximately 386 square miles or 245,981 acres. The escarpments of the North and South Mountains form the north and south boundaries respectively, the eastern boundary consists of the Minas Basin and the Avon River, and an imaginary line running north and south through Annapolis Royal would form the western boundary.

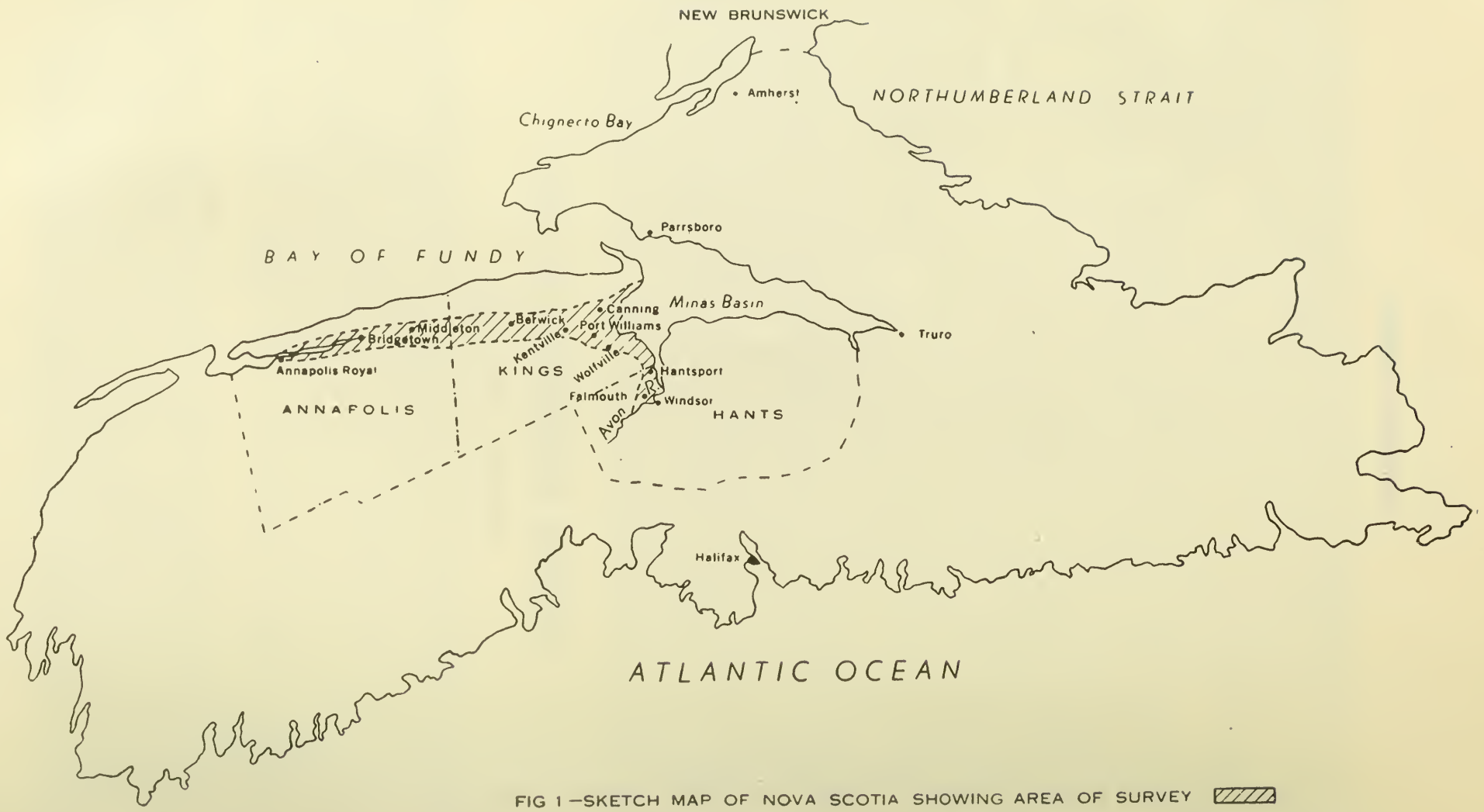


FIG 1 —SKETCH MAP OF NOVA SCOTIA SHOWING AREA OF SURVEY

Physiography

Nova Scotia lies within the major physiographic region known as the Atlantic Coastal plain of North America. In Canada this consists of Nova Scotia, New Brunswick and Prince Edward Island, or the Acadian Region[1].

Nova Scotia has two main physiographic divisions, namely, the comparatively uniform uplands, stretching from the Atlantic Ocean to New Brunswick, and the broad lowlands and wide trough-like depressions or valleys[2].

The Annapolis Valley is one of the largest and most important of the lowland areas; it is 85 miles long from the head of St. Mary's Bay, traversing the northern part of Digby County, Annapolis County and Kings County to its eastern boundary along the Pereau shore of Minas Basin. The general relief is undulating to gently rolling, with a general slope north and south from the North and South Mountains to the Annapolis and Cornwallis Rivers.

Underlying the Valley throughout its extent are the comparatively soft rock formations of the Triassic periods, consisting of brick red sandstone, and occasional pebble beds and shales. These are covered by a comparatively shallow over-burden of glacial boulder clay and sands; also by tidal marshes and flats. The colour of the rocks in many cases has beeen imparted to the soils, thus giving them their characteristic appearance.

Within the area surveyed, the elevation ranges from 25 feet above the mean sea level along the Annapolis and Cornwallis Rivers to 300 feet on the north side of the Valley, and from 200 feet to 500 feet on the south side. North of the Annapolis and Cornwallis Rivers, and extending from Bridgetown to Kentville, the change in elevation is comparatively uniform and gradual. As the higher elevation along the base of the North Mountain is reached the topography becomes more rolling. At approximately 300 feet above the sea level the Valley terminates abruptly and the steep, straight wall of the Trappean ridge, known as the North Mountain, rises to a height of 500 feet to 600 feet above sea level.

From Kentville to the shore of Minas Basin, the Valley widens and merges with the lowlands surrounding Minas Basin. This region is divided by watercourses into three cape-like sections. One lies between the Cornwallis River and the Canard River, the surface relief is undulating with gentle slopes toward the rivers. The highest elevation is 200 feet, between Kentville and Port Williams.

Between the Canard River and Habitant Creek lies another section; the highest elevation in this area is 100 feet and the relief is smoother and more undulating. North of the Habitant Creek the terrain gently slopes towards the Pereau Creek, the general topography is undulating to gently rolling.

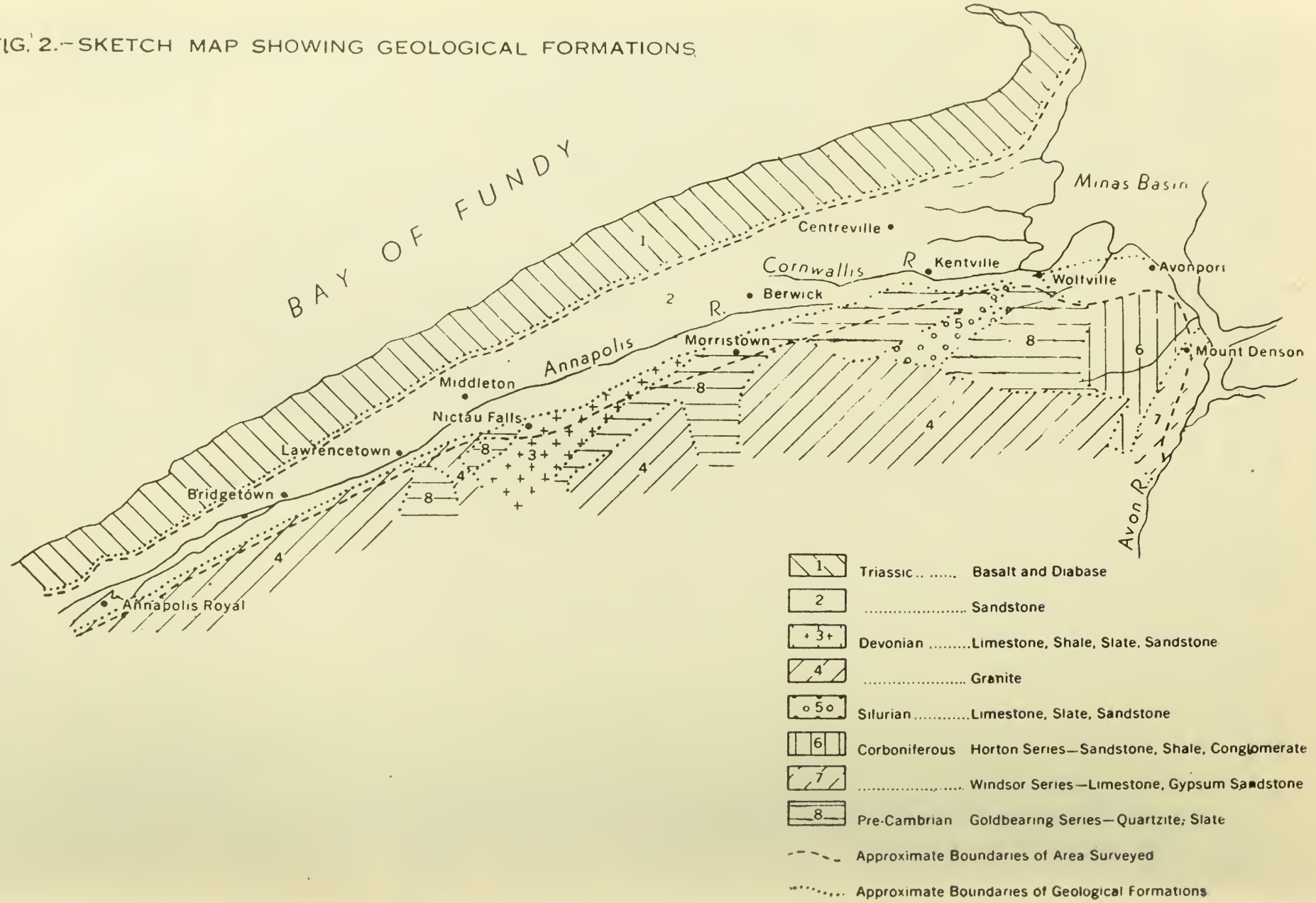
South of the Annapolis and Cornwallis Rivers, the line of demarcation between the Valley and the southern upland is not so clearly defined, being masked by what are locally known as the foothills, although it is more pronounced in some places than in others. Between Annapolis Royal and Middleton, the Valley is relatively narrow, the North and South Mountains being almost parallel. The general relief is level to gently undulating; the limits of the Valley and the upland are fairly distinct.

The geological formation underlying the South Mountain in this section of the Valley is chiefly Precambrian quartzite and Devonian granite (Fig 2). From Nictaux Falls to Kentville the Valley widens. The general relief is undulating to gently rolling. The rock formation is mainly Precambrian and Devonian slates. The influences of the processes of weathering upon these softer rocks has been more marked than upon the granites and quartzites, resulting in a more rolling topography.

---

[1] Handbook of Canadian Geology—Sir J. W. Dawson, 1889.
[2] Physiography of Nova Scotia—J. W. Goldthwaite, 1924.

FIG. 2.—SKETCH MAP SHOWING GEOLOGICAL FORMATIONS



At an elevation of 200 to 250 feet the Valley proper merges with the more rolling topography of the South Mountain slope to obscure the boundary between the Valley and the southern upland. East of Kentville the area surveyed consists of a narrow strip of undulating lowland lying between the Cornwallis River and the Precambrian and Silurian slates of the South Mountain.

At Wolfville the Annapolis Valley loses its identity; the lowland area covered by this survey continues from Wolfville to Avonport, south to Mount Denson, then along the left bank of the Avon River. The surface relief is rolling with a general elevation ranging from 100 to 175 feet or 200 feet. The underlying geological material of the Carboniferous formation consists of Horton shale and sandstone between Wolfville and Mount Denson, and gypsum of the Windsor series from Mount Denson to the Avon River.

Extending in a southwesterly direction from Avonport, parallel with and south of the Cornwallis Valley, is the Gaspereau Valley. This Valley traverses the region of weaker carboniferous rocks of the Windsor series for a distance of approximately six miles, from Avonport to Gaspereau. Throughout this distance it maintains a width of approximately half a mile. From Gaspereau, where it commences to penetrate the more resistant Precambrian and Devonian rocks, the Gaspereau Valley gradually becomes narrower until at White Rock, it becomes a narrow, steep-walled erosion gorge. The section of the Valley from Avonport to Gaspereau was included in this survey. The Valley floor is narrow, level and partially terraced.

Prominent among the physiographic features of the area surveyed are the large areas of tidal flats or dykelands of Grand Pre, the Canard River and smaller areas along the Cornwallis River, Habitant Creek, Avon River and the Annapolis River west of Bridgetown. Outside the dykes protecting the older tidal flats, more recent deposits of marine and estuarine silt or salt marsh have been formed, and are being continually reworked by the tides.

Along the shore of Long Island are indications of a buried forest.

Drainage

The drainage system of the area surveyed is all exterior, having the final outlet into the Bay of Fundy. In the Annapolis-Cornwallis Valley the drainage conforms to the general slopes of the region, that is north and south from the respective mountains, and towards the Annapolis and Cornwallis Rivers. These two rivers originate on the Annapolis-Cornwallis watershed in the vicinity of Berwick at an elevation of 170 feet above sea level. Rising south of Berwick, the Annapolis River flows westward to Bridgetown where it empties into the Annapolis Basin, and through it into the Bay of Fundy, via the Digby Gut.

The Cornwallis River rises north of Berwick, swinging south towards Waterville, and then east; it empties into the Minas Basin at Wolfville. Numerous streams and erosion gullies emptying into the two rivers provide a herring-bone-like drainage system for the Valley. Most of the tributaries flowing into the Annapolis River drain the heavier-textured soils on the north side of the Valley, although the largest tributary, the Nictaux River, flows from the south. The Cornwallis River is nearer the South Mountain than the North, consequently the streams from the south are shorter and more rapid.

East of Kentville and north of the Cornwallis River, the Canard River, and the Habitant and Pereau Creeks, flowing parallel to the Cornwallis River and emptying into the Minas Basin, are important factors in the drainage system of the eastern end of the Valley.

While the drainage of the Valley is, in the main, adequate, local conditions vary. Seepage occurs along the slopes of the mountain, more particularly along the South Mountain where the slope is more gradual. North of Berwick and west of Auburn, the internal drainage is poor. Immediately west of Berwick a

large peat bog has developed in what was probably a small lake bed; a smaller bog lies south of Aylesford. On the more rolling area, drainage may be excessive as is also the case on the sandy soils of the Valley floor.

The chief drainage outlet for the narrow area of arable land in the Gaspereau Valley is the Gaspereau River. While the surface drainage between Avonport and the Avon River is adequate, the heavier subsoils restrict the internal drainage. Drainage in this area is effected by the Halfway River and the Avon River which empty into the estuary of the Avon River and finally into Minas Basin.

A remarkable feature about the drainage within the area is that of the dykelands. Although the general elevation of the dykelands is below the tidal level these flats have, as a rule, moderately good drainage. Throughout the area there are numerous depressions that receive the run-off from adjacent higher ground.

Climate

The climate of the region surveyed is temperate, and is more or less representative of that prevailing throughout Nova Scotia. It is perhaps somewhat modified by the influence of the North and South Mountains and in the east by Minas Basin. The mountains afford a certain amount of shelter from gales, but not total protection; occasional high winds sweep through the Valley causing considerable damage to fruit crops. Prevailing gale winds are northeasterly, the full force of gales being felt more towards the centre, and along the south side of the Valley, as compared with the north side, which is partially protected by the North Mountain escarpment.

Data provided by the Dominion Meteorological Service, are given in the following tables.

The annual mean precipitation is around 40·74 inches, varying from 28·33 inches in the driest year to 51·69 inches in the wettest year. It is usually well distributed throughout the year, the winter period having slightly more rainfall than the remainder of the year. During the winter months snowfall is responsible for a large proportion of the precipitation, the amount of snowfall for the period December to February being about 58·6 inches out of a total yearly fall of 81·2 inches.

The mean temperature for the three stations is around 43·5 degrees F.; fluctuations range from a mean (daily) minimum of 34·5 degrees F. to a mean (daily) maximum of 52·3 degrees F. It is seldom that extremes of heat or cold occur, the temperature ranging from moderate to cool.

During the winter season the temperature occasionally falls below zero, the lowest on record being 24 degrees below, at the Kentville Station. The winter mean ranges around 23·9 degrees F., February being the coldest month, with a monthly mean of 21·4 degrees F. Temperatures at the Kentville Station are generally lower than the average for the three stations, with those at Annapolis Royal being higher.

The summers are comparatively short and cool. The highest temperature reached is 96 degrees F., registered at Wolfville, the mean summer temperature being 62·9 degrees F. The number of extremely hot days is relatively small and it is seldom that even on the hottest days the temperature does not drop towards evening, so that the nights, as a rule, are cool. Summer temperatures at Kentville are slightly higher than at either Annapolis Royal or Wolfville.

Considering that apples are the major crop grown in the Valley, it is important to note that during the dormant season, temperatures warm enough to advance fruit buds to a stage where they are susceptible to damage at a later date, are rare over most of the region. The mean temperature for the period November to April is 29·7 degrees.

The frost-free period is of considerable importance because of the risk involved in the production of certain crops. The prevalence of frost in some

TABLE I.—PRECIPITATION DATA—MONTHLY, SEASONAL AND ANNUAL MEANS AND EXTREMES FOR ANNAPOLIS ROYAL, KENTVILLE AND WOLFVILLE

Month	Annapolis Royal, April, 1914, to Dec., 1936 Total Precipitation in Inches						Kentville, April, 1913 to Dec., 1936 Total Precipitation in Inches						Wolfville, March, 1898, to Dec., 1936 Total Precipitation in Inches					
					Snow						Snow						Snow	
	Average Monthly Fall	Greatest Amount in One Month	Total Amount in Driest Year	Total Amount in Wettest Year	Average Monthly Fall	Greatest Amount in One Month	Average Monthly Fall	Greatest Amount in One Month	Total Amount in Driest Year	Total Amount in Wettest Year	Average Monthly Fall	Greatest Amount in One Month	Average Monthly Fall	Greatest Amount in One Month	Total Amount in Driest Year	Total amount in Wettest Year	Average Monthly Fall	Greatest Amount in One Month
December	4·49	9·08	3·75	4·41	18·5	67·0	4·03	5·63	3·87	3·70	18·4	39·8	4·15	6·95	2·63	5·00	19·6	46·7
January	4·21	8·60	2·68	3·46	18·6	44·0	4·03	8·69	4·75	4·86	19·3	44·5	4·10	8·50	2·30	4·26	21·7	60·0
February	3·49	6·45	2·91	3·39	18·9	49·0	3·24	6·57	1·26	3·76	20·2	59·5	3·24	5·65	1·71	4·03	20·7	43·5
Winter	12·19	9·08	9·34	11·26	56·0	67·0	11·30	8·69	9·88	12·32	57·9	59·5	11·49	6·95	6·64	13·29	62·0	60·0
March	3·32	6·58	2·08	2·42	10·3	36·0	3·11	4·59	0·95	4·56	13·6	40·5	3·29	6·50	2·35	2·35	14·0	51·6
April	2·94	9·20	1·92	3·02	3·5	10·5	2·97	5·72	1·70	2·87	5·3	27·5	3·00	5·39	1·81	3·28	5·1	20·5
May	2·29	5·08	0·81	2·81	Trace	1·0	2·42	6·52	2·50	2·32	0·2	2·6	2·42	5·50	1·28	3·47	0·4	9·0
Spring	8·55	9·20	4·81	8·25	13·8	36·0	8·50	6·52	5·15	9·75	19·1	40·5	8·72	6·50	5·44	9·10	19·5	51·6
June	2·87	5·22	1·16	3·05	.....	.....	2·77	4·97	2·43	3·14	.....	.....	2·63	4·65	4·21	1·63	.....	.....
July	3·50	7·18	3·18	2·64	.....	.....	3·03	5·63	1·52	2·06	.....	.....	2·85	6·31	1·19	5·28	.....	.....
August	3·22	10·45	2·0	6·86	.....	.....	3·19	9·39	3·84	5·24	.....	.....	3·13	9·26	2·22	9·26	.....	.....
Summer	9·59	10·45	6·34	12·55	.....	.....	8·99	9·39	7·79	10·44	.....	.....	8·61	9·26	7·62	16·17	.....	.....
September	3·54	7·92	1·06	4·04	.....	.....	3·29	8·06	0·85	5·79	.....	.....	3·15	6·70	3·67	1·73	.....	.....
October	4·16	9·01	3·02	9·01	Trace	1·5	4·46	11·69	3·11	11·69	Trace	1·0	4·01	11·44	1·97	5·32	0·2	3·0
November	3·92	8·35	2·50	4·75	4·0	13·8	3·85	7·71	2·81	6·36	5·7	39·8	3·89	7·91	2·98	3·26	5·4	24·2
Autum	11·62	9·01	6·58	17·80	4·0	13·8	11·60	11·69	6·77	23·84	5·7	39·8	11·05	11·44	8·62	10·31	5·6	24·2
Year	41·95	10·45	27·07	49·86	73·8	67·0	40·39	11·69	29·59	56·35	82·7	59·5	39·87	11·44	28·32	48·87	87·1	60·0

TABLE II.—MONTHLY, SEASONAL AND ANNUAL MEANS AND EXTREMES IN TEMPERATURE AT ANNAPOLIS ROYAL, KENTVILLE AND WOLFVILLE

Monthly	Annapolis Royal[1]									Kentville[2]									Wolfville[3]								
	Mean	Mean Maximum	Mean Minimum	Highest Monthly Mean	Lowest Monthly Mean	Extreme		Highest	Extreme	Lowest	Mean	Mean Maximum	Mean Minimum	Highest Monthly Mean	Lowest Monthly Mean	Extreme		Highest	Extreme	Lowest	Mean	Mean Maximum	Mean Minimum	Highest Monthly Mean	Lowest Monthly Mean	Extreme		Highest	Extreme	Lowest
						A	B		X	Y						A	B		X	Y						A	B		X	Y
December	28·2	34·9	21·5	33·3	21·8	67	54		−11	4	25·2	30·7	19·8	31·4	17·8	64	54		−14	− 1	26·6	33·7	19·6	32·5	19·7	66	55		−13	2
January	24·1	32·1	16·1	30·5	15·3	51	48		−13	−2	20·6	27·4	13·9	27·9	10·1	60	51		−22	−9	22·4	30·9	13·8	29·4	13·3	60	53		−14	−6
February	23·3	31·2	15·4	30·3	14·0	61	48		−13	−2	19·8	27·0	12·6	27·4	10·9	54	47		−24	−9	21·1	20·0	13·2	20·0	13·2	56	47		−16	−5
Winter	25·7	32·7	17·7	.....	.....	67	54		−13	−2	21·9	28·4	15·4	.....	.....	64	54		−24	−9	23·4	31·2	15·6	.....	.....	66	55		−16	−5
March	31·4	39·3	23·5	39·3	22·9	71	57		−5	6	29·4	36·5	22·3	38·8	20·7	71	56		−13	3	30·0	37·8	22·3	38·2	22·3	71	55		−7	5
April	40·7	49·6	31·8	45·1	36·4	77	66		10	20	39·6	47·7	31·4	44·0	35·0	79	66		5	19	39·8	48·2	31·5	45·1	37·0	76	66		10	20
May	50·5	61·0	39·9	53·7	44·2	86	75		20	29	45·8	60·5	31·1	54·0	48·8	89	78		23	27	48·8	57·6	40·1	55·6	48·4	89	77		21	29
Spring	40·9	50·0	31·7	.....	.....	86	75		−5	6	38·8	48·2	28·3	.....	.....	89	78		−13	3	39·6	47·9	31·3	.....	.....	89	77		−7	5
June	59·2	69·6	48·7	65·7	56·2	89	88		26	36	59·6	70·7	48·6	69·5	56·2	92	85		32	36	58·9	69·1	48·7	87·8	54·4	90	82		30	37
July	64·3	74·3	54·3	67·6	61·2	88	83		30	43	66·0	76·7	55·3	67·4	64·0	94	88		37	42	65·6	75·5	55·7	70·0	60·9	95	86		39	45
August	63·6	73·5	53·8	66·0	59·9	91	83		36	43	64·5	75·2	53·9	67·4	62·2	93	87		36	40	64·3	74·0	54·6	67·7	60·8	96	85		38	44
Summer	62·4	72·5	52·3	.....	.....	91	83		26	36	63·4	74·2	52·6	.....	.....	94	88		32	36	63·0	72·9	33·0	.....	.....	96	85		30	37
September	57·5	66·7	48·3	62·5	52·9	88	79		28	34	57·4	67·3	47·6	63·2	54·0	91	52		26	32	57·5	66·5	48·2	63·0	55·4	90	80		88	35
October	49·6	58·9	40·2	52·3	42·5	78	72		22	26	38·5	57·0	40·0	50·9	31·8	83	74		17	25	48·6	57·1	40·2	55·8	46·9	83	74		20	28
November	38·8	46·0	31·6	43·9	33·1	72	62		8	16	37·2	43·1	31·4	42·9	29·9	70	63		3	13	37·8	44·8	30·8	43·4	32·0	71	63		6	16
Autumn	48·6	57·2	40·0	.....	.....	86	79		8	16	47·7	55·8	39·7	.....	.....	91	82		3	13	48·0	56·3	39·8	.....	.....	90	80		6	16
Year	44·3	53·1	35·4	67·2	14·0	91	....		−13	.....	42·8	51·6	34·0	69·5	10·1	94	....		−24	.....	43·5	52·1	35·1	70·0	13·2	96	....		−16	.....

[1] Period April, 1914, to December, 1936.
[2] Period April, 1913, to December, 1936.
[3] Period March, 1898, to December, 1936.

A Extreme highest on record.
B Average of extreme monthly maximum.
X Extreme lowest on record.
Y Average of extreme monthly minimum.

TABLE III.—FROST DATA—ANNAPOLIS-CORNWALLIS VALLEY REGION. PERIOD 1917 TO 1936

Station	——	Late Frost		Day of Year	Temp.	Early Frost		Day of Year	Temp.	Frost free period	
		Month	Day			Month	Day				
Annapolis Royal	Average	May	21	142	31	October	8	281	31	139	68–221
	Earliest	April	29	90	30	September	9	252	32	162	144
	Latest	July	2	184	30	November	7	311	30	127	
Kentville	Average	May	21	142	31	September	29	273	31	131	102–166
	Earliest	May	7	127	30	September	12	255	31	128	134
	Latest	June	3	153	32	October	20	293	29	140	
Wolfville	Average	May	12	132	31	October	11	284	31	152	128–190
	Earliest	April	24	114	30	September	29	272	31	158	159
	Latest	May	24	144	32	October	31	304	32	160	

TABLE IV.—AVERAGE VALUES OF BRIGHT SUNSHINE IN HOURS

——	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Period of Observations
Kentville	78	97	133	154	203	213	299	216	169	136	86	58	1913–35
Wolfville	87	106	147	161	214	226	241	234	177	150	98	66	1913–35
Annapolis Royal	62	84	133	162	217	216	219	214	159	136	81	44	1918–35
Average for 3 stations.	75·6	95·6	137·3	159	211·3	218·3	229·6	221·3	168·3	104·6	88·3	56	

areas also has a bearing on the agricultural value of some types of soil. The data in table 3 show a variation in the number of frost-free days in the vicinity of the different stations.

At Annapolis Royal the shortest period is 68 days and the longest 221 frost-free days, the average 139 days. At Kentville, the shortest period is 102 days and the longest 166 days, with an average of 134 days; and at Wolfville, the shortest period is 128 days, while the longest is 190 days, and the average 159 days.

Kentville is situated on the margin of what may be termed the Valley floor and it is in this Valley floor area, particularly from Aylesford to Wilmot, that the frost hazard is the greatest. Although definite meteorological data are not available for this area, it is known that in occasional years no month is free from frost.

Data for the hours of sunshine are given in table 4. The annual mean for the three stations reported is 1,825 hours, with 1,729 hours at Annapolis Royal, 1,842 hours at Kentville and 1,907 hours at Wolfville.

It is to be noted that approximately 40 per cent of the annual total hours of sunshine for the area occur during the three months, May, June and July. This is of particular significance since this period of greatest concentration of hours of sunshine coincides with the bloom period also with the season of the year during which spraying and dusting operations are done.

Vegetation

The natural vegetation within the area surveyed was originally forest stands of coniferous and mixed coniferous and hardwood associations. According to the forest cover and vegetative map, 1930, prepared by the Department of the Interior, Ottawa, the types of trees comprising these associations were: pine, spruce, tamarack, white birch, maple, beech, oak and elm.

Very little of the virgin forest remains in the Valley. Most of the uncleared land is now covered with stands of second or later growth, consisting of alder, poplar, white birch, red maple, balsam fir, spruce and scrub pine. On the higher slopes of the North and South Mountains, more mature stands still exist.

While the major climatic coincidence of the area is relatively uniform, local differences, influenced by elevation, have affected the type and distribution of the vegetation. Observations made in the course of the soil survey have indicated three broad groupings, based mainly upon the predominating species of trees. The three groupings noted are the central pine forest area, the area of mixed spruce and deciduous forest, and the hardwood forest area.

Boundaries between the different associations are not clearly defined, particularly between the mixed forest and the hardwood associations, members of some species being found in both associations. The central pine association is more distinct. The pine forest area is associated with the dry, sandy soils of the Valley floor. Where mature groves exist, they consist of dense stands of red and white pine with practically no ground flora. On the cut-over areas poplar and white birch are found, with a ground cover consisting of brown crowberry, hudsonia, brake and sweet fern.

The mixed spruce and deciduous association is found on the more rolling areas of the Valley and along the lower slopes of the North and South Mountains. The soils generally are heavier textured throughout the profile and more retentive of moisture. White spruce is the dominant species, with white birch, tamarack, hemlock, balsam fir, alder, poplar and some maples interspersed. The undergrowth and ground cover consists of juniper, sweet fern and bracken.

On the heavier-textured soils of the area between Avonport and Windsor, yellow birch, sumac, silver poplar and hawthorn are more commonly found. Occupying the higher slopes of the mountains, particularly the South Moun-

tain, the forest cover is mixed hardwood and spruce with the hardwoods dominant. This association includes sugar maple, beech, yellow birch, white birch, red oak, ash, hemlock, poplar and some spruce. A noticeable feature of this association is the ground flora which includes clintonia, jack-in-the-pulpit, painted trillium and such ferns as the cinnamon and ostrich ferns.

Within the area mapped are developed two main peat bog areas with a distinctive vegetative cover. Some of the species identified are rhodora, sheep-

NATURAL VEGETATION CHARACTERISTIC OF THE ANNAPOLIS VALLEY AREA

Group	Botanical Name	Common or Local Name
Central Pine Forest	Pinus Strobus	White pine
	Pinus resinosa	Red pine
	Populus tremuloides	Aspen
	Betula populifolia	Wire birch
	Myrica asplenifolia	Sweet fern
	Corema Conradii	Brook crowberry
	Arctostaphylos Uva-ursi	Bearberry
	Hudsonia ericoides	Hudsonia
	Melampyrum lineare	Cow wheat
	Danthonia spicata	Wild oat grass
	Panicum depauperatum	Poverty grass
Mixed spruce and Deciduous	Picea canadensis	White spruce
	Picea rubra	Red spruce
	Larix laricina	Tamarack
	Tsuga canadensis	Hemlock
	Acer rubrum	Red maple
	Betula lutea	Yellow birch
	Acer spicatum	Mountain maple
	Populus grandidentata	Poplar
	Prunus virginiana	Chokeberry
	Spiraea latifolia	Meadowsweet
	Linnaea borealis	Twin flower
	Mitchella repens	Partridge berry
	Geum rivale	Purple avens
	Osmunda cinnamomea	Cinnamon fern
Hardwood Forest	Acer saccharum	Sugar maple
	Fagus grandifolia	Beech
	Quercus borealis	Oak
	Fraxinus americana	White ash
	Lonicera canadensis	American fly-honeysuckle
	Taxus canadensis	Yew
	Viburnum alnifolium	Hobble-bush
	Acer pennsylvanicum	Striped maple
	Trillium erectum	Purple trillium
	Trillium undulatum	Painted trillium
	Oxalis Acetosella	Wood sorrel
	Arisaema triphyllum	Jack-in-the-pulpit
	Dryopteris spinulosa	Wood-fern
Peat Bogs	Rhododendron canadense	Rhodora
	Ledum groenlandicum	Labrador tea
	Kalmia angustifolia	Sheep laurel
	Vaccinium oxycoccus	Small cranberry
	Sarracenia purpurea	Pitcher plant
	Chamaedaphne calyculata	Leatherleaf
Salt Marsh	Spartina pectinata	Marsh grass
	Puccinellia maritina	
	Salicornia europaea	Glasswort
	Suaeda martinina	Sea-blite
	Spergularia Salina	Spurrey

laurel, Labrador tea and pitcher plant. The tidal flats support a typical vegetation as represented by marsh grass and sea-blite. A list of the vegetation identified within each vegetative grouping is given. This is not a complete list, nor must it be inferred the species shown within a group are confined to that area. It is given as an indication of the species of plants and trees of common occurrence within the area mapped.

History and Population

With the founding of Port Royal, now known as Annapolis Royal, by the French in 1605, the first settlement of white people in Nova Scotia was established. Prior to that time a temporary fishing station existed at Canseau or Canso, where trading with the Indians was also carried on. The Indian population of the area surveyed is now approximately only 400.

Between the years 1605 and 1755 the population of Acadia, as Nova Scotia was then called, was mainly French, and centred in what is now known as the Annapolis Valley, the region covered by this survey. Fishing, trapping and trading with the Indians were the main sources of livelihood of the pioneers while they were clearing the bush and dyking the tidal marsh lands to make farm homes. Settlement was slow, partly because of the retarding effect of the wars and local feuds between the French and British.

Although Nova Scotia had been ceded to Great Britain in 1713, and Halifax was founded in 1749, there were very few British settlers in the Valley, except at Annapolis Royal, until after the expulsion of the Acadians in 1755. French population at this time was around 3,000 to 4,000 people; small communities had been started at Horton, Gaspereau, Cornwallis and Grand Pre. After the expulsion of the Acadians the Valley was devoid of settlement for about six years. In 1760 settlers from New England and Connecticut became established and in 1763 there were about 500 families of white people.

The greatest stimulation to settlement and to the agricultural development of the area occurred with the advent of the United Empire Loyalists between 1775 and 1783. It is from this Anglo-Saxon pioneer stock that a large percentage of the present population is descended. The early settlements were naturally developed along the estuaries of the rivers and along the shores of the Minas Basin where the tidal marshes, which the French settlers first started to dyke in 1670, provided grazing lands for live stock, and the waterways the only means of transportation. Settlements were isolated and there were no carriage roads. In 1855 the first railroad was built between Windsor and Halifax, this was extended to Annapolis in 1869. The region was well adapted to live stock raising, and, as the French settlers apparently realized, was also suited to apple trees; the earliest record of apple trees being planted is 1633.

It is only natural that with a suitable climate and situation for apple growing, the apple industry should be the dominant factor in the agricultural progress of the region; but it is also an important live stock raising and dairy farming region. It is interesting to note that although agriculture is the dominant industry and the population therefore mostly rural, only about 50 per cent is located on farms. In 1931 the farm population was 47·9 per cent of the total for the area surveyed.

The growth of the apple industry has, however, resulted in the development of a number of towns where plants for the processing of apple by-products and numerous storage and shipping warehouses are located. With the expansion of the orchard acreage and more intensive cultural practices, new agricultural problems developed. Plant diseases, insect pests, sprays and methods of spraying, plant nutrition, soil fertility and many other problems have presented difficulties to the farmers.

In 1893 a school of horticulture was organized at Wolfville and later merged with the Provincial Agricultural College at Truro, and in 1910 a Dominion Experimental Station was established at Kentville. These two organizations supported by the Dominion and Provincial Departments of Agriculture, are actively engaged in the investigation of the numerous problems.

TABLE 5.—DATA ON POPULATION AND DISTRIBUTION BY COUNTIES IN THE AREA SURVEYED (approximate figures)

Population, County	Annapolis	Kings	Hants
Total	16,297	24,357	19,393
Population area surveyed—total	6,145	23,164	1,562
Population area surveyed—urban	1,936	5,688	683
Population area surveyed—rural	4,209	17,476	879
Population on farms	2,902	11,286	615
Per cent rural	68·5	75·4	56·2
Per cent on farms	47·0	48·7	39·3
Tenure occupation of land	658	2,821	122
Owners	632	2,589	98
Tenants	17	104	14
Part owners and part tenants	9	128	10

Estimated from data, Census of Agriculture, N.S., 1931.

Transportation and Marketing

To build up an industry of such importance as the apple industry of Nova Scotia it is evident that an efficient transportation and marketing system must be developed. One of the main factors contributing to the growth of the apple industry of the Annapolis Valley region has been the close proximity of the area to the seaboard.

The Valley is served by two railway lines, the Canadian National Railway and the Dominion Atlantic Railway. The latter is a subsidiary line of the Canadian Pacific Railway. The provincial and municipal systems of roads provide easy access to the railroads. The main highway running through the Valley from Annapolis Royal to Halifax is hard surfaced, the remainder of the roads are principally gravelled. Fifty per cent of the farmers within the area are within 5 miles of a town or railway station and practically all are within 25 miles of town or railway station, or both.

Prior to 1929 Halifax was the main seaboard terminal for the Valley. In that year Port Williams on the estuary of the Cornwallis River was developed as a seaboard terminal. The first recorded shipment of apples was in 1849 when apples grown near Paradise, Annapolis County, were shipped by sailing vessel from Halifax to Liverpool. In 1861 a cargo of 2,000 barrels was shipped from Annapolis Royal to England and in 1878 two cargoes of 4,000 and 7,000 barrels also left Annapolis Royal for England[1]. These cargoes all went by sailing vessels. The first shipment of apples by steamer was in 1881 when 6,800 barrels were shipped direct to London, England[2].

Packing and sorting were done in the orchard for the autumn varieties, and in the house cellar or barns for the winter varieties. With the expansion of the

[1] History of Annapolis County—Savage.
[2] Apple Industry of Nova Scotia—W. V. Longley, 1931.

industry more storage space and better facilities for packing and grading were required. To meet the new demands frost-proof warehouses have been built along the railroad tracks. The first track warehouse was built about 1890. There are now 150 or more warehouses in the Annapolis Valley and adjoining districts. The average capacity of these warehouses is around 10,800 barrels[1] with a total capacity of around 1,400,000 barrels[2].

A more recent development in the marketing facilities is the building of cold storage and pre-cooling plants; also installation of refrigeration plants in the boats and the building of refrigerator cars for the railroads. In the early days of the export trade the apples were usually consigned by the growers to commission houses in London, England. As the industry developed buying agencies were established in the region.

As a natural outgrowth of the competition in marketing the crop and the need for larger storage and handling facilities, marketing organizations were formed. These organizations may be grouped into three classes: co-operatives, individual or independent shippers, and line warehouse companies. In addition to the organizations for marketing the whole fruit, there are thirteen plants engaged in processing non-exportable fruit[3]. Cream is gathered by trucks and carried to the four creameries operating in the district. The butter is sold principally in the domestic market. Eggs and poultry are sold privately or through pools to the domestic market, the principal market for eggs being Halifax, with a limited number exported to the West Indies. Cattle are marketed, principally as the dressed product, for the domestic market. Hogs are consumed on the local domestic market or shipped through shipping clubs, alive to packers at Moncton or sold as the dressed product for the Halifax market.

Agricultural Development

The early agriculture of the Annapolis Valley region was necessarily that of a pioneer subsistence type. The supplying of farm products to the garrisons located in the settlements provided a limited market for the early farmers but the majority of the farm produce was used for home consumption. As in all pioneer settlements, the agricultural traditions and the immediate requirements of the settlers would regulate to a large extent the kind of crops grown.

The early settlers of Port Royal, now Annapolis Royal, cleared small plots of land and sowed them to wheat, rye, barley, oats, beans, hemp, turnips and pumpkins for domestic use. The census figures for 1671 show that 441 settlers had 429 arpents or 360 acres of land under cultivation, with a live stock population of 806 cattle, 407 sheep and 36 goats[4].

After the expulsion of the French settlers in 1755 and before the entry of emigrants from the New England States in 1760 occurred, the fields and farmsteads were practically deserted. With the coming of the new settlers agriculture revived and expanded. In 1762 there were 14,340 acres under cultivation; hay, grain and potatoes for domestic use being the principal crops. During the next 50 or 60 years agricultural progress was slow and marked by a certain amount of lethargy until the years 1818-1820 when the letters of Agricola aroused a keener interest in the status of the industry. Agricultural societies began to be formed; improved methods of cultivation and in live stock breeding were introduced. During the following years settlement increased, urban as well as rural adjustments took place to meet the changing conditions coincident with the development of the province at large.

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[1]Apple Industry of Nova Scotia—W. V. Longley, 1931.
[2]Records of Survey—C. A. Eaves.
[3]C. C. Eidt, An. Rpt. N.S.F.G.A., 1936.
[4]Canada Year Book 1924—p. 186.

The raising and fattening of beef cattle was the principal source of farm revenue, supplemented by the sale of dairy butter. Cattle would be pastured in the rougher upland pastures during the early summer, and in the autumn were brought down to the succulent feed of the intervale and dykelands.

Towards the end of the 19th century a trend towards dairying began, partly owing to the growth of an urban population with the consequent demand for dairy products; also in a large measure, to the cheaper production of beef cattle in the West. Individual farms and in some cases districts turned to dairying. In the earlier years of this change dairy butter was the primary dairy product, with some cheese. The first cheese factory in Nova Scotia was established at Paradise in the year 1870.

A marked trend towards dairying commenced in the western section of the Valley area about the year 1900 and in the eastern section around 1910. Dairy farming received its greatest impetus during the war years 1914 to 1918, partly because of curtailed shipping facilities for apples, but largely because of the increased prices for dairy products. The establishment of creameries has also been a factor influencing the trend towards dairying. Although the replacing of dairy butter production by cream for sale to the creameries was slow, the Valley area now produces approximately 33 per cent of the total butter production of the province.

The development during the past ten years of a fluid milk market in the city of Halifax has provided a source of revenue of growing importance to the farmers of the Valley. In the year 1911 the milch cow population of the three counties, Annapolis, Kings and Hants was 21,158 and in 1931 the figure was 23,528[1] of which number approximately 49·2 per cent or about 11,583 head[2] were located within the area covered by this survey. Four breeds of dairy cattle are represented in the herds in the following order of importance in numbers, Guernsey, Jersey, Holstein and Ayrshire.

Although the trend in live stock farming has been more towards the dairy breeds in recent years, the beef breeds of cattle provide a significant part of the farm revenue. Shorthorns are the dominant breed with some Herefords. As in the case of the dairy cattle, approximately 50 per cent, or about 12,517 head of the beef cattle in the three counties are found in the area surveyed.

With the growth of the dairy industry hog raising increased as a necessary economic side line. In 1911 the hog population of the three counties was 18,673. Although a decline in the number of hogs occurred, it is significant to note that of the 11,642 hogs recorded in 1931, 6,476 were located in the Valley area.

A growing source of revenue that has developed within recent years is the poultry industry. This is a sideline that can be worked in very favourably with orcharding. Prior to 1920 the poultry in the area was practically all in farm flocks. Since that year there has been developed a growing commercial industry, the greatest expansion having taken place since 1931. Of the 37 chick hatcheries in Nova Scotia in 1940, with a production of 516,209 chicks, 10 are located in the Valley area and produced 359,438 chicks[3].

In the production of eggs and dressed poultry the Valley district leads the province, both in volume and quality. Of the 5,809,231 dozen eggs produced in the province in 1931 approximately 1,363,653 dozen were produced in the area surveyed.

Potato growing, both for the certified seed market and for table stock, also strawberry growing, are other sidelines that are included in the cash crop program of the Valley farmers. It is thus evident that although the Annapolis

[1] Dominion Census 1911 and 1931. [2] Estimated from the above census data.
[3] Data provided by C. Benoit, Provincial Poultry Production Expert.

Valley region is known as the largest continuous orchard belt in the Dominion of Canada, general farming, including dairying are important sources of agricultural wealth in the region. Something like 35 to 40 per cent of the total agricultural wealth of the province is produced in this territory.

The early French settlers introduced apple trees to the Valley in the year 1633. By the year 1698 there were 1584 apple trees planted. These were in small domestic orchards and the fruit was used for home consumption as dried fruit, cider and vinegar. In the year 1880 the apple crop was around 101,000 barrels. The acreage and production increased steadily. About 1890 the farmers began to realize the possibilities of apple growing on a commercial scale, and between 1890 and 1910, was the period of greatest expansion and planting[2].

[2] Information supplied by C. M. Collins, Provincial Horticulturist.

The trees planted at this time form the major part of the producing orchards of the present day. The acreage now under orchard planting is around 30,386 acres, with approximately 1,620,000 trees, producing about 2,000,000 barrels annually.

From the small beginning of 700 barrels in 1849, which brought in a revenue of $1,925, the apple industry has grown to be the chief single revenue producer in the region. The average annual production for an eight-year period, 1931 to 1938, is 1,929,562 barrels with returns amounting to $3,695,826.[1]

The annual expenditure for commercial fertilizers and spray materials is large. In 1931 the outlay was $464,150 for fertilizers and $227,371 for spray materials. Much of the fertilizer is bought as mixed goods, but separate ingredients also are purchased, to be mixed on the farm or used alone, to meet the particular needs of the individual crop. Fertilizers for general farm crops are drilled in with the grain or sown broadcast, rates of application and kind of mixture varying according to the particular crop, cultural practices and soil conditions. Formulae of the mixtures used are variable, some of the more popular ones being 2-12-6, 4-8-4, 4-8-10, 5-10-5, 5-9-8 for grain, roots and potatoes. For apple trees a general use is made of a 9-5-7 mixture.

Superphosphate and nitrate of soda are used in considerable amounts as a means of supplying individual ingredients as supplementary top dressings. Rates of application range from 150 to 550 lb. per acre for grain crops, 400 to 1,200 lb. per acre for root crops, and from 500 to 1,000 lb. per acre for apple trees.

While the main source of motive power for farm machinery is horses, of which there are 5,800 head[2] in the area mapped, oxen and tractors are also used in considerable numbers. With the increase of mechanization, both for the more rapid farm operations and for road transport, oxen are regaining favour as a source of motive power for such types of work as spraying, where steady and cheap power is required. Farms generally are well equipped, many having modern labour-saving machinery. Modern practices and methods of cultivation are closely followed in an endeavour to maintain the fertility of the soil which is so essential in an area where specialized farming has become a dominant factor.

SOILS

Soil Survey Methods

The farmer is or should be interested in the soil of his farm; when his crop fails he should endeavour to know the cause. He may examine the soil himself, submitting it to certain simple tests. During the last century field descriptions of soils have become more complex and laboratory methods have been developed to assist in explaining their descriptions.

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[1] A. E. Richards—Public Affairs, Aug. 1940, p. 15.
[2] Dominion Census, 1931.

Land classification must be largely based on soil classification. Variations in soils occur within small areas necessitating care in obtaining samples for expensive analysis. Recognition of these facts and of the importance of available plant food make it evident that use must be made of information from field as well as laboratory.

The main part of a soil report is conceded to be a record, with explanations of field observations, mapping, and opinions as to methods of improving soil conditions. In field work, usually two men select a block of land, between two roads for example; they travel along the roads noting the general topography, banks along the roads, rivers and railway cuttings, character of vegetation, soil and subsoil; then diagonally cross the area on foot as may times as necessary to compare soils within the area with those along the road. Holes are bored to ascertain variations in depths of horizons, colour, texture, etc. Topographical maps are used as guides to the area and also for recording important locations, such as where marked changes in soil occur and where samples were taken. The soil surveyor compiles all the information derived from field observations.

From this information obtained by the surveyor, all soils with the same parent material and same arrangement of layers in the profile, no matter how far separated geographically, are grouped in a series. The series are given names, such as the Nictaux Series and the Berwick Series; usually the name of the place where such soil is first found is used. If the upper layer of the profile in one area of a series is found to be sandy and another, even a short distance away, is loamy, the surveyor considers he has two types, namely Nictaux sand and Nictaux loam. From topography, borings and cuttings, he locates the approximate borders, that is, the area of these types, and if large enough, charts them on a map to show their location relative to natural and artificial features of the area, as houses, schools, lakes, brooks and roads.

In supplementing the work of the soil surveyor, the chemist uses tests for available plant food and for total phosphoric acid and nitrogen, for relative amounts of clay and sand and other factors. The results of the chemical tests when correlated with the soil surveyor's data provide information useful to the farmer.

Soil Formation

A brief discussion of soil formation should contribute to a better understanding of the soils covered by this report.

Soils are the product of many factors of environment which have influenced and are influencing their development. These factors are, the physical and mineralogical composition of the parent material or rock debris accumulated and deposited by geologic agencies; the climate under which the soil has been developed; topography which influences soil temperatures, drainage, aeration and susceptibility to erosion; biological agencies, chiefly vegetation which acts upon and modifies the mineral material; and the length of time the various forces have been acting upon this mineral material.

As a result of the interaction of all these soil-forming agencies soils possess definite characteristics which are observed in what is known as the soil profile, a vertical section extending from the surface down to the unmodified mineral material or to bed-rock.

The climatic and biological conditions prevailing in Nova Scotia have favoured the development of what are known as podsols. Podsols are soils normally developed under conditions of high precipitation; long, cold winters; short, cool summers; and usually coniferous forest vegetation.

Such conditions favour strong leaching. The soluble bases, calcium, magnesium, and potassium, also iron and aluminum are carried out of the upper layers or horizons down to lower levels, where they accumulate to form a

new horizon. Under certain conditions the new horizon may be of hardpan character due to the cementing action of organic colloids or iron compounds.

The climatic conditions of the Annapolis Valley region have favoured this leaching or podsolization process; directly, due to the relatively high precipitation, and indirectly, through the influence on the type of natural vegetation.

In the previous section, page 14, the original vegetation of the area has been given as principally coniferous forest growth. The forest litter, or mat of leaf and twig debris on the surface, from such a forest type is slow to decompose and is comparatively low in bases. The rate of decomposition and the amount of bases in the forest litter will influence the amount of organic matter on and in the surface soil and the rapidity of the leaching process.

The degree of podsolization will, under local conditions, be influenced by the kind of parent materials, their texture and mode of deposition. If the parent material is composed of minerals that decompose readily or are low in bases, leaching will be more rapid than where the mineral material is high in calcium or resists weathering. The texture and mode of deposition will influence the movement of water through the soil; water-deposited parent material of a porous sandy texture will permit more rapid leaching than will material of a clay texture.

The parent materials from which the Valley soils have been developed were deposited either by ice or water. Some of this till was moved considerable distances, a large part of it however was moved comparatively short distances and has been influenced by the underlying rock formations and those of the surrounding uplands.

While there are some limestone formations adjacent to the area, most of the bed-rock in the area surveyed, with the exception of the Triassic sandstone, contains little, if any, lime carbonate. Even where the original rock material did contain appreciable amounts of lime, such as in the Triassic sandstone where the binding material was calcium carbonate, the parent materials generally are low in soluble constituents because the climatic conditions have not been favourable for the preservation of these substances. When the kind of climate, type of vegetation and nature of the parent materials concerned in the development of the Valley soils are considered, it is to be expected that these soils would be naturally low in organic matter and strongly leached, conditions which are reflected in lower natural fertility levels than soils which are developed under drier climatic conditions on parent material high in lime or other bases.

Differences in topography are responsible for differences in soil development, for instance soils situated on smooth, level or depressional topography where the water-table may be high much of the year, or those occurring on the long smooth slopes frequently found along the south side of the Valley where seepage areas occur, exhibit characteristics different from those soils developed from similar materials on more rolling topography, where natural drainage is rapid and the water-table several feet below the surface.

An observable characteristic influenced by drainage is soil colour. Poorly-drained soils will usually have dark coloured surface horizons due to the accumulation of organic matter. The subsoils generally are dull, greyish or mottled in colour owing to poor oxidation resulting from the poor circulation of air within the soil. The surface colours of well-drained soils are generally lighter because of the lower organic-matter content which may be due to slow accumulation, rapid decomposition or to erosion effects on the more rugged topography. Bright colours in the subsoil, such as reds and browns, are indicative of well drained and properly aerated soils.

The degree to which the various soil-forming processes affect the development of the soil in any region is influenced by the length of time the parent materials have been subjected to their activities.

Soils like the intervale or river bottom lands in the Valley, which are subject to annual flooding, therefore constant renewal by new deposits of material from the uplands, show little or no profile differentiation and are considered to be immature soils. In soils developed on the undulating uplands, where the climatic and vegetative agencies have had ample time to influence the soil, a mature or normal profile is developed.

An ideal, normal profile for the Annapolis Valley region should, under undisturbed natural forest conditions, have the following profile development or sequence of layers:

A_o A relatively thin layer of forest litter in various stages of decomposition.

A_1 A dark coloured layer, comparatively thin, containing a relatively high content of organic matter mixed with mineral matter.

A_2 A bleached or light ashy grey layer, the layer of maximum leaching, ranging in thickness from 1 inch to 12 inches.

B Usually a darker coloured layer, the layer of greatest accumulation. Frequently loose and friable in the upper part, becoming firmer to compacted or indurated in the lower part, also darker in colour.

C Parent material, partially modified rock material.

D Underlying stratum—bed-rock, clay or sand, unrelated to the parent material, may or may not influence the overlying soil.

Individual profiles do not necessarily show the same sequence of horizons as given above. One or more horizons may be absent, or any one or all may be further subdivided, giving rise to a more complex profile.

The soil reaction of the Valley soils generally, is strongly acid throughout the profile.

Soil Classification

In the previous section it has been stated that soils possess definite features which are expressed in the soil profile. Upon the basis of these profile characteristics soils are classified into units, groups or categories. The units most commonly used and of greatest agricultural significance are series, type and phase.

The soil series is the most important, it being the unit in which the effects of local environment, particularly character of the parent material, topography and drainage have their fullest development.

Soil type is a finer division within a series, recognized because of the fact that textural differences, particularly of the surface layer or horizon, may be found in any or all soil series mapped; also because of the importance of surface texture in soil management and utilization.

In some cases a sub-group within the soil type, based upon differences in relief, stoniness, erodibility or some such factor is separated; this is the phase. Gravelly and rocky phases have been mapped in the Valley survey.

Twenty-three series of mineral soils (including 41 soil types and 8 phases), also 2 organic soils and 4 miscellaneous soils have been mapped. These have been classified in the following manner:

Classification Scheme for Annapolis Valley Soils

A—Zone—Podsol.

B_1 Soils on Glacial Till

C_1 Clay Till

D_1 Well drained

Middleton Series

Pelton Series.

CLASSIFICATION SCHEME FOR ANNAPOLIS VALLEY SOILS—*Concluded*

A—Zone—Podsol.—*Con.*

D_2 Imperfectly drained
Kentville Series
Falmouth Series
Wolfville Series.

D_3 Poorly drained
Hantsport Series
Lawrencetown Series.

C_2 Sandy Till

D_1 Well drained
Somerset Series
Woodville Series
Bridgetown Series
Morristown Series
Berwick Series

D_2 Imperfectly drained
Annapolis Series.

B_2 Soils on water-deposited parent material

C_1 Sandy parent material

D_1 Well drained
Cornwallis Series
Canning Series

D_2 Imperfectly to poorly drained
Avonport Series
Millar Series

C_2 Gravelly to cobbly parent material

D_1 Well drained
Gaspereau Series
Nictaux Series
Pereau Series
Prospect Series
Torbrook Series

C_3 Clay parent material

D_1 Imperfectly drained
Fash Series

B_3 Organic Soils

D_1 Poor drainage
Muck
Peat

B_4 Miscellaneous Soils

C_1 Drainage variable, depending upon daily or seasonal fluctuations in water levels.
Dykeland
Bottom land
Salt marsh

C_2 Generally well drained to excessive
(*a*) Eroded or non-agricultural land.

The above classification scheme recognizes the broad effects of climate and vegetation in the first category, namely podsol zone. Most of the soils exhibit, to a greater or lesser extent, some degree of podsolization.

The mode of deposition, the character of the parent material and the kind of rock material influencing it, as well as drainage conditions, are factors which locally modify the effects of climate and vegetation, and they have been considered in establishing the different soil series.

Variations within any given soil type as shown on the map are inevitable. Many isolated small areas of one or more distinct types, must upon occasion, be included with the prevailing soil type occurring upon the individual farm.

The detailed descriptions of the various soil series given in the following pages will enable the farmer or agricultural worker to identify these small areas of soil with those of the more extensive areas mapped.

Soil Series Descriptions

Soils on Glacial Till

The soils developed over glacial till cover approximately 52·8 per cent of the area surveyed. They all have some profile characteristics in common, such as general sequence of horizons, colour and degree of compactness. Differences in drainage, texture of the till and the rock material mainly influencing it are reflected in the development of the different series.

These till soils can be separated into two broad textural groups, those developed over clay, constituting the heavier-textured soils of the area; and those developed over a sandy till, giving rise to what might be termed the medium-textured soils of the area.

The following series have been developed over clay till; Middleton, Pelton, Kentville, Falmouth, Wolfville, Hantsport and Lawrencetown. They have all been podsolized to a greater or lesser degree. Although the natural fertility is, as a general rule, relatively high, good treatment is necessary in order to maintain satisfactory productivity levels.

Surface soil colours range from light or greyish-brown to brown on the well-drained soils, to dark brown where drainage is poor and the organic-matter accumulation is higher. The subsoils are reddish in colour, firm to compact, invariably having a well developed structure.

The change from subsoil to substratum is, as a general rule, rather gradual, being marked by slight variations in colour, loss of structure and frequently greater friability of the 'C' horizon as compared with the 'B' layer; also the presence of undecomposed rock material.

Surface drainage generally is adequate; the surface soils being porous, readily absorb rainfall. The character of the subsoil influences the amount of percolating water retained and the rate of internal drainage.

Because of their fine texture, soils of this group, especially the better drained series where the topography is undulating to rolling, are liable to erosion damage. Particular attention to management and tillage practices is essential for the maintenance of a satisfactory organic-matter content and surface soil structure, in order to prevent removal of the surface soil with the consequent loss of fertility and moisture capacity.

The soils developed from the sandier or lighter-textured till are Somerset, Wolfville, Bridgetown, Morristown, Berwick, and Annapolis.

While the substrata or parent material of these series are firm, in some cases compacted, they are more friable and porous, having a higher gravel or stone content than the clay till soils. The origin of the rock material and the degree of compaction are factors considered in making series separations.

The soils of this sandy till group differ from those of the clay till in that they appear to have been slightly modified by water action.

Surface soils are brown to dark in the uncultivated soils, invariably lighter coloured under cultivation, owing to the depletion of organic matter.

The subsoils are yellowish-brown to red-brown; coarser in texture than those of the clay till soils, with a tendency to some structural development.

Their surface layers readily absorb rainfall, dry quickly after rains and are easy to work. Internal drainage, generally, is good and permits satisfactory root penetration and development.

Topography is irregular, ranging from undulating to rolling. Except for the Woodville and Somerset Series, the relief is not well adapted to the use of all types of modern farm machinery. Isolated fields or larger areas of smoother land on benches or smooth slopes could be used for general farming. As a rule, however, the relief is more suited to orchards for which the soils are well adapted.

Woodville and Somerset soils, with their smoother topography can readily be worked with modern machinery and are suitable for general farming, and specialized crops such as orchard and potatoes. The Somerset soils will require more careful management than the Woodville soils because of moisture relations. The natural fertility of all soils of the sandy till class is fair to moderately good. Careful management and judicious use of commercial fertilizers should increase productivity.

Well-Drained Soils on Clay Till

MIDDLETON SERIES

(18,086 acres or 7·3 per cent of total area)

The Middleton series comprises one of the most important and most extensive groups of soils in the area. These soils occupy the rolling to slightly hilly terraces and slopes along the base of the North Mountain escarpment, extending from Dempsey Corner in Kings County to Granville Ferry in Annapolis County. A small area has been mapped around South Williamston on the South Mountain slope.

Developed on a boulder clay or till, derived mainly from Triassic sandstone and trap rock material, these soils comprise one of the heaviest textured series in the area. From Elliott Station to Granville Ferry the area narrows and the soils are more variable, having a deeper and sandier profile than is usually found in this series.

Although among the heaviest soils of the region, the Middleton soils are possessed of adequate drainage, the gently rolling to hilly topography and the numerous erosion gullies provide facilities for fairly rapid surface drainage. On the steeper slopes, especially where the vegetative covering has become thin, surface erosion may cause considerable loss of surface soil, and with it natural fertility.

Internal drainage is moderately good. While the heavy, stiff subsoil could be expected to retard the downward movement of water, the nut-like structure permits fairly free movement, ensuring good drainage generally. It is only occasionally that the greyish mottling found in the Kentville soils occurs in the Middleton series, such a condition being found in the slightly imperfectly drained soils on the smoother topography.

Except for the narrow belt between Clarence and Granville Centre the surface is comparatively free from rocks. Such rocks as occur are mainly trap and some granite. Gravel in varying amounts occurs throughout the profile, some areas being quite gravelly, such as north of Middleton.

The surface layer is usually light or greyish-brown to brown in colour, varying from 4 to 8 inches in thickess, and has a crumb-like structure. This structure, however, is frequently destroyed under conditions of continuous cultivation and the depletion of organic matter.

Immediately below the darker coloured surface soil, a narrow, irregularly developed layer may be present, greyish-yellow in colour and frequently lighter in texture than the surface soil, having little or no definite structure. The subsoil is a compact, chocolate brown or brownish-red clay, varying in thickness from 12 to 24 inches and exhibiting a fairly well developed nut-like structure which facilitates root penetration and internal drainage. Small stones or pebbles are sometimes found.

Below this horizon is a more friable substratum of reddish-brown to red clay loam to clay, containing fragments of partially weathered trap rock. Within this series two types have been mapped, with gravelly and stony phases; Middleton Loam and Middleton Clay Loam. The clay loam is the dominant type and one of the most important soils of the Valley. A representative profile description is as follows:—

A	0″– 6″	Light greyish-brown clay loam, slight structure.
	6″– 9″	Light greyish or light greyish-yellow loam to clay loam.
B	9″–31″	Chocolate brown clay, well developed nut-like structure. Quite firm and stiff, but not impervious to root penetration. Sometimes contains small stones or pebbles.
C	below 31″	A reddish-brown to red clay, more friable than B, containing greenish and black coloured cobbles and fragments of weathered trap rock.

With the exception of the A horizon, there is no marked differentiation between horizons, the colour changes from B to C layers being gradual. Under cultivation the upper part of the heavier, more compact subsoil is liable to be mixed with the shallow surface soil, giving it a brownish-red or chocolate cast.

Middleton loam is frequently lighter in texture and brighter in colour in the A_2 horizon, also in the upper part of the B horizon, than is the clay loam, especially west of Bridgetown and east of Welton Corner, also south of Weston Station where the Middleton and Pelton series meet. Although the soils of this series contain from 20 to 30 per cent of fine clay, they are fairly easy to work because of the gravel content, ranging in some cases from 20 to 40 per cent, which gives to the soil greater friability than otherwise would be the case. Where the gravel content is low and especially where the organic matter is also low, the surface soils are liable to become hard and baked with shrinkage cracks appearing in the surface. Under such conditions, the soil will be difficult to work.

Middleton soils, as a rule, are fairly well supplied with organic matter (8·5 per cent), especially the clay loam. The loam type is slightly lower. Soil reaction of the clay loam is strongly acid in the surface soil, pH being as low as 4·7, decreasing with depth to slightly acid in the C horizon, pH 6·5 or higher. The loam soils are more strongly acid throughout. Under current cultural practices, where heavy applications of superphosphate and some lime have been made, the acidity of the surface soil has been decreased to a slightly acid condition, pH 6·0.

Legumes, so much needed, will be hard to grow on account of surface deficiency in bases and available phosphoric acid. Considering the physical nature of these soils and the relatively high organic-matter content, the moisture-holding capacity should be fairly high.

Practically all the area occupied by Middleton soils from Dempsey Corner to Clarence, and from Granville Centre to Granville Ferry, is cleared, and in general crops, orchards and pastures. Some of the best commercial orchards in the region are located on this series. From Granville to Bridgetown the orchard plantings are smaller than further east, consisting mainly of older trees.

Both the loam and clay loam types are well suited to general crops and apples, particularly the earlier maturing varieties. Little, if any, difference is

made in the utilization and handling of either type. The clay loam which usually occurs on the smoother topography and lower slopes is used for grain, hay and pasture to a greater extent than is the loam type. Because of its position, slightly higher acidity and greater tendency to dry out, the loam is not quite so well suited to hay and pasture as the clay loam, particularly under conditions of continuous cutting and grazing.

Dairying, beef cattle and general farming provide a considerable part of the farm income, especially in the sections where orcharding does not predominate. The principal farm crops are oats, barley, field roots (turnips and mangolds) and mixed hay. Grain yields average from 30 to 40 bushels per acre. Where a good rotation is followed, liberal applications of commercial fertilizers made and humus content maintained, yields around 50 to 60 bushels and as high as 85 bushels have been obtained. Hay yields are moderately good, about 1½ tons per acre. For successful catches of clover, applications of lime are necessary. A considerable proportion of the cleared land is in pasture with the turf generally comparatively thin and weedy.

The natural fertility of these soils is fair and leaching is not so pronounced as in other soils of the region. While these soils are what are often referred to as fairly strong soils, the productive capacity can be increased by sound cultural practice.

Surface erosion is liable to cause appreciable loss of fertility and damage to the Middleton soils, because of the rolling topography and fine texture, unless the surface soils are protected by maintaining a good turf and careful management.

PELTON SERIES

(12,560 acres or 5·1 per cent of total area)

The Pelton series consists of medium to heavy-textured soils, showing the influence of fine-grained sandstone or clayey shale. They are found on the smoothly rolling slopes extending along the base of the North Mountain escarpment, from Dempsey Corner to Lyons Cove.

The area is traversed by numerous stream courses and erosion gullies. Drainage is well established; in some cases surface drainage may be excessive, causing loss of surface soil and fertility through erosion. Few stones or boulders are found on the surface or in the profile. Shale fragments occur in varying amounts, being quite plentiful in the shallower profiles.

The surface soil is light brown in colour, mellow and has a slight granular structure in the uncultivated soil. A yellow to yellowish-brown subsurface layer, mellow and structureless, frequently occurs immediately below the surface. This is followed by a yellowish-brown to light reddish-brown subsoil, heavier in texture than the surface layer and having a fairly well developed nutty structure.

The substratum is redder in colour than the subsoil, lighter and more variable in texture, becoming quite sandy with depth. Fragments of sandstone and red shale occur. Unweathered shale may be reached within five feet or less from the surface, but is usually deeper. The lower substratum is known locally as "Ochre" or "Marl."

When wet, Pelton soils have a sticky and greasy consistency. In some cases the upper part of the B horizon may be loose, friable and of a deep yellow colour. Northeast of Lakeville, at the base of the Pelton Mountain near Lyons Brook and quite frequently in the narrow belt of the loam type west of Buckley's Corner, the soil has been eroded and the shale bed-rock occurs within three feet of the surface.

A representative profile consists of:

A 0″— 6″ Light brown clay loam, fine granular structure, mellow.

6″—12″ Pale yellow to light brownish-yellow clay loam, structureless, loose and mellow.

B 12″—30″ Light reddish-brown clay loam, quite firm, nut-like structure.

C below 30″ Reddish-brown fine sandy loam to clayey loam. More friable than B. Contains fragments of partially decomposed shale fragments.

Three types have been mapped, sandy loam, loam and clay loam. The loam is the most extensive type and occurs on the more rugged topography, closer to the base of the escarpment. It has been more subject to erosion. The surface invariably is thinner than that of the clay loam, the profile showing less development and usually has a higher content of shale fragments. Owing to its heavier texture, indicating higher proportion of fine clay particles, the clay loam will have a greater capacity for retaining moisture than has the loam.

Pelton sandy loam is definitely sandier in all horizons, the subsoil being more of a fine sandy loam to loam. The prevalence of shale fragments in the profile and the general soil development being very similar to that of the heavier type, is the basis for inclusion in this series.

The Pelton soils have much less gravel than the Middleton soils and less fine clay; sand and silt are correspondingly increased. The higher silt content probably explains the smoother feel or greasy consistency of the Pelton soils. These soils will require careful handling.

Soil reaction (pH 5·0 or less) is strongly acid throughout the profile, different from the Middleton soils. Lime at the rate of 2 tons per acre is needed for satisfactory crop production, especially legumes. Phosphoric acid, both total and available, is extremely low in all horizons, except the A horizon. The organic-matter content, under natural conditions, is only fair, but cultivation in the orchards has reduced it to a low level. Their relatively high clay content and close proximity to the heavily wooded North Mountain, from which a steady seepage occurs, provide a fairly uniform moisture supply throughout the season. The general relief and the physical characteristics of the profile ensure adequate drainage and aeration.

Pelton soils are utilized for fruit growing, general farming, and dairying. Some excellent orchards are located on all three types in this series and they are being more extensively developed. Oats, roots, fodder corn, and timothy hay are the main field crops, producing very satisfactory yields, oats yielding as high as 60 bushels per acre and hay around $1\frac{1}{2}$ tons per acre. Clover cannot be grown sucessfully without applications of lime. Because of its smoother topography, the clay loam is more suitable for the use of tillage machinery, so perhaps more favourable for general farming than is the loam type; all types are suited to fruit trees and the lighter soil types should prove suitable for potatoes.

These soils are considered among the most productive in the Valley, but they, like the Middleton soils, are liable to be damaged and suffer loss through surface erosion because of their fine texture and position. This is especially true where grasslands are allowed to become thin and in orchards where clean cultivation is practiced. Attention to the maintenance of an adequate organic-matter content is essential for the preserving of a desirable physical condition, and a satisfactory level of soil fertility.

Imperfectly-Drained Soils on Clay Till

KENTVILLE SERIES

(13,871 acres or 5·6 per cent of total area)

The soils of this series are medium to heavy in texture, resembling the Wolfville series in many respects. They are derived from a fairly heavy till or boulder clay which appears to have been influenced mainly by the Triassic sandstone and to some extent by trap rock material from the North Mountain.

Kentville soils occupy the undulating to smoothly sloping topography extending from Kentville to Port Williams, east of Hillaton; also between Lawrencetown and Bridgetown on the north side of the Annapolis River.

While there is sufficient variation in the general relief to ensure surface drainage, the nature of the subsoil is such as to cause the movement of groundwater to be slower than is desirable for a well-drained soil. In ordinary seasons drainage is moderately good.

Some boulders and rocks, chiefly trap rock, are found on the surface in the Lawrencetown-Bridgetown section. As a rule, however, the surface is fairly free from large rock debris. Gravel is present in the profile. It consists chiefly of smoothly rounded pebbles, principally igneous material such as quartz and trap rock with occasional amygdaloidal pebbles and cobbles.

The surface soil is dark greyish-brown to dark brown in colour. Under intensive cultivation the colour is often a lighter brown with a greyish tinge. A slight granular structure sometimes occurs where conditions are favourable. Below this the surface is a greyish colour, frequently mottled with yellow.

Subsoils are usually heavier in texture than the surface soil, firm but not impervious, a yellow-brown to brownish-red in colour. The upper part is usually friable and may be mottled with yellow. The lower part is firmer, occasionally slightly mottled with yellow and invariably streaked with grey along old root channels and cleavage faces. The structure is not well developed. When wet the soil has a tendency to be sticky.

The substratum is a deeper or darker red in colour, more friable and gritty. Often a reddish and greenish sandstone material will be reached below 5 feet from the surface.

Variations in sequence of horizons and texture of the subsoils are sometimes found. The B_1 horizon may be fairly coarse sandy loam; or a layer of reddish, coarse, sandy loam may occur between layers of sandy clay loam. In some cases the subsoil may not exhibit any marked differentiation into sub-horizons.

Two types are mapped, Kentville sandy loam, and Kentville loam. A profile description of Kentville sandy loam, the dominant type, is as follows:—

A	0″– 4″	Dark greyish-brown sandy loam, fair granular structure.
	4″–10″	Ashy grey or dull light grey sandy loam, loose, structureless, with possibly some mottling.
B	10″–22″	Yellow to light brown sandy loam to sandy clay loam, friable with some yellow mottling.
	22″–46″	Brownish-red, gritty sandy clay loam, quite firm; streaked with grey and containing numerous small black chips or fine pebbles of trap rock. Breaks down with a faint nut-like fracture. Plastic when wet.
C	below 46″	Grades into a darker red sandy clay loam, gritty and more friable than B_2, but quite firm.

The surface soil of the sandy loam type, which occupies the undulating to gently rolling topography, is generally lighter coloured than the loam. It is a greyish-brown or light brown, due to lower organic-matter content. Structure

is not so well developed and the surface soils sometimes become crusted. This crust is easily disintegrated by cultivation. While the subsoil is firm, the higher content of coarse particles in the sandy loam permits slightly better internal drainage than is the case with the loam.

The loam type, which occurs principally between Kentville and Port Williams, has a smoother topography, with a gentle slope towards the Cornwallis River. The surface soil is darker in colour and often thicker than is that of the sandy loam type. The A_2 horizon is not so well or regularly developed and frequently has a dull lustre. The higher organic-matter content, hence darker coloured surface soil, and the duller cast to the sub-surface or A_2 layer of the loam are associated with slower drainage conditions as compared with the sandy loam type. Slower drainage may be due to a slightly heavier texture in the subsoil or to the closer proximity of bed-rock to the surface, which has resulted in the occurrence of seepage spots in the loam type.

The chemical data on page 77 show Kentville sandy loam to be low in both total and available phosphoric acid (·08 per cent and 40 lb. per acre). As this soil is strongly acid (pH 4·9) in reaction and has a high lime requirement (5 tons per acre) phosphorus deficiency is likely to be a limiting factor in crop production. Liberal applications of phosphate fertilizers will be necessary. While the surface soils are moderately well supplied with total nitrogen (·2 per cent) and have a fair organic-matter content, the ratio of carbon to nitrogen, 26 to 1, is very wide which would suggest that the nitrogen content is not any too abundant for good production. This is borne out by the low nitrogen content of the orchard soils, except the A layer. The moisture-holding capacity compares very favourably with that of other clay till soils.

The natural fertility level of the Kentville sandy loam as indicated by the base exchange data is only fair. The base saturation value 39·1 shows that bases, lime and potash, have been leached out to a great extent. Such is a poor soil and the only remedy is lime in some form.

A large proportion of the Kentville sandy loam is still in woodland, particularly west of Middleton. The tree growth is mainly spruce, with some birch, maple, pine, poplar and alder. Ground juniper, sweet fern, bracken and mosses are among the ground cover. West of Middleton the clearings are scattered and small in extent. They are mainly used for oats, hay (timothy, with some clover) and pasture, orchard plantings are small and scattered. East of Kentville, orchards are more extensive and under favourable conditions of tillage and drainage, are among the most productive in the Valley, yields ranging from 95 to 200 barrels or more per acre having been obtained. Such yields indicate that Kentville soils, especially the sandy loam, are favourable for fruit trees.

General farming and vegetable growing are other sources of farm revenue on these soils. Oats, field roots, fodder corn and mixed timothy and clover hay are the principal farm crops. (Fig. 8.) Yields range from 25 to 65 or 70 bushels per acre for oats, 500 to 700 bushels per acre for turnips, with mangolds slightly higher, potatoes around 175 bushels per acre and hay 1 to 3 tons per acre.

Like many other soils of the region the Kentville soils are not natural hay or pasture soils. Because of the strongly acid reaction the herbage of the hay or pasture fields will deteriorate under continuous cutting and grazing. Short rotation cropping with the liberal use of manure, commercial fertilizer and lime are necessary for satisfactory yields.

FALMOUTH SERIES

(7602 acres or 3·1% of total area)

This series in which three types have been established, consists of medium to heavy-textured soils which have been developed from till deposited over gypsum and argillaceous shale of the Windsor series. Occupying the lowland

area lying between the Gray Mountain section of the southern upland and the Avon River estuary, and extending from the Halfway River to Upper Falmouth, this series comprises one of the most important groups in the region surveyed.

Although the rolling topography characteristic of the Falmouth series ensures adequate surface drainage, the heavy texture of the substratum interferes with the free internal drainage. Unlike the Middleton and Wolfville series, there are few natural drainage courses traversing the area of Falmouth soils. This is reflected in the imperfect drainage conditions. Another feature of the relief of the area is the presence of funnel shaped depressions considered to be the result of subsidence of the soils due to undermining of the gypsum rock by underground waters.

Stones and boulders are not a serious factor, gravel is found in varying amounts throughout the profile, but not in sufficient quantities to interfere with cultivation. Occasional outcrops of gypsum rock occur.

The surface soil is brown in colour, with a light greyish or light yellowish cast when dry, lacking in definite structure and may develop cracks in very dry seasons when cultivated. Below this is a greyish-yellow subsurface, frequently heavier in texture and sometimes showing a weak plate-like structure.

The subsoil is heavier in texture than the surface soil, exhibits a fairly well developed nut-like structure and is quite hard when dry, but plastic and sticky when wet. A brown to reddish-brown colour with a dull or greyish cast is characteristic; in some cases the upper subsoil may be yellower than normal. This grades into a compact reddish-brown substratum, frequently containing fragments of partially weathered rock material which gives a gritty feeling to the soil. Although the firmness of the subsoil slows the internal drainage, it does not prohibit root penetration.

Exposures along the Avon River show that at 10 feet or more an abrupt change occurs between the reddish soil and the bluish-black clay or "Blue Plaster" as it is locally called. This in turn is underlain by the white crystalline gypsum rock.

Some variations are found in the profile development, layers or pockets of sand occurring in the subsoil; on the crests of some of the sharper grades the surface and subsurface may be quite thin, the latter sometimes being totally absent.

The soil around Falmouth and Upper Falmouth is, in general, heavier in texture than is the case towards Mount Denson where the shale and sandstone of the underlying Windsor series and adjacent Horton series have apparently a greater influence.

Organic-matter content of Falmouth soils is moderately good, especially in the heavier-textured Falmouth clay loam. The moisture-holding capacity is quite similar to the Middleton and Morristown soils. Soil reaction is medium to strongly acid (pH 5·3 to 5·0) in the upper part of the profile, decreasing with depth to the C horizon where it may become slightly acid (pH 6·0 or higher) although the substratum, generally, is moderately acid. In other profiles of orchard soils the pH of the surface soil is much lower. Total phosphoric acid generally is low, in the subsoil very low, but the nitrogen is fairly high and the exchangeable potash high.

The Falmouth sandy loam, the largest in extent but mainly covered with woodland, is usually more gravelly than the heavier types, and the upper part of the subsoil will often be quite sandy. The loam type occurs on the smoother topography, extending along the highway from Halfway River to French Mill Brook. The subsoils are heavier throughout than the sandy loams, but friable and porous enough to permit fair drainage. Around Upper Falmouth a small area of clay loam is mapped.

FIG. 3.—Somerset sandy loam, showing comparatively shallow penetration into the compact subsoil.

FIG. 4.—Erosion gully, started as a shallow furrow, now about 8 feet wide and 7 feet deep. Result of 5 years' water action on a sparsely protected surface.

FIG. 5.—Boulder pavement associated with Annapolis sandy loam and on other parts of the South Mountain slopes.

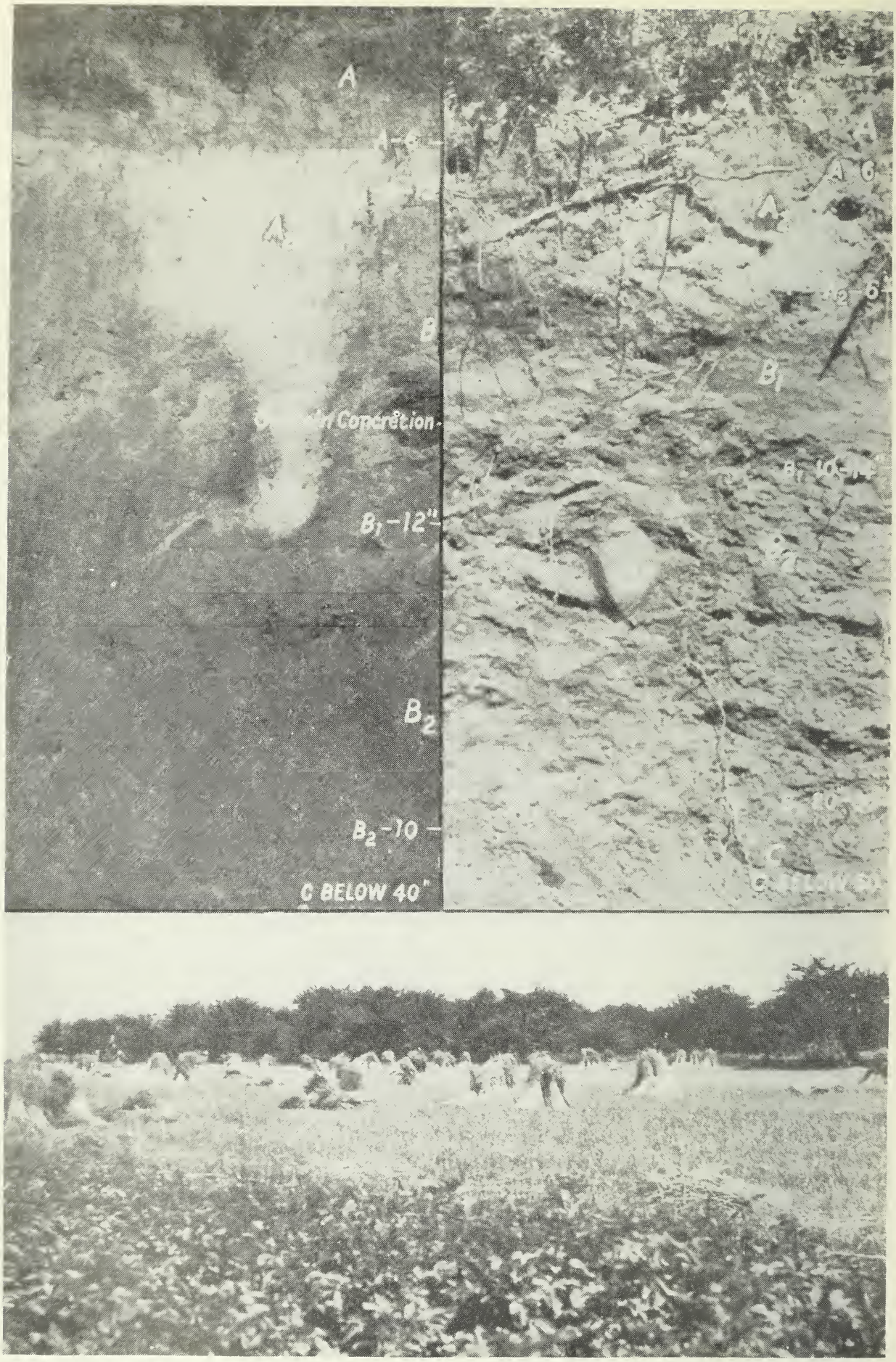

FIG. 6.—Cornwallis sand. Note the incipient A1 development, irregular tongue-like development of A2 and the pebble-like formation of ortstein in the B1 layer.
FIG. 7.—Woodville sandy loam. Note the root penetration through the B2 horizon.
FIG. 8.—Good crops of potatoes, and oats as well as thrifty orchards are grown on such soils as those of the Kentville and Woodville series.

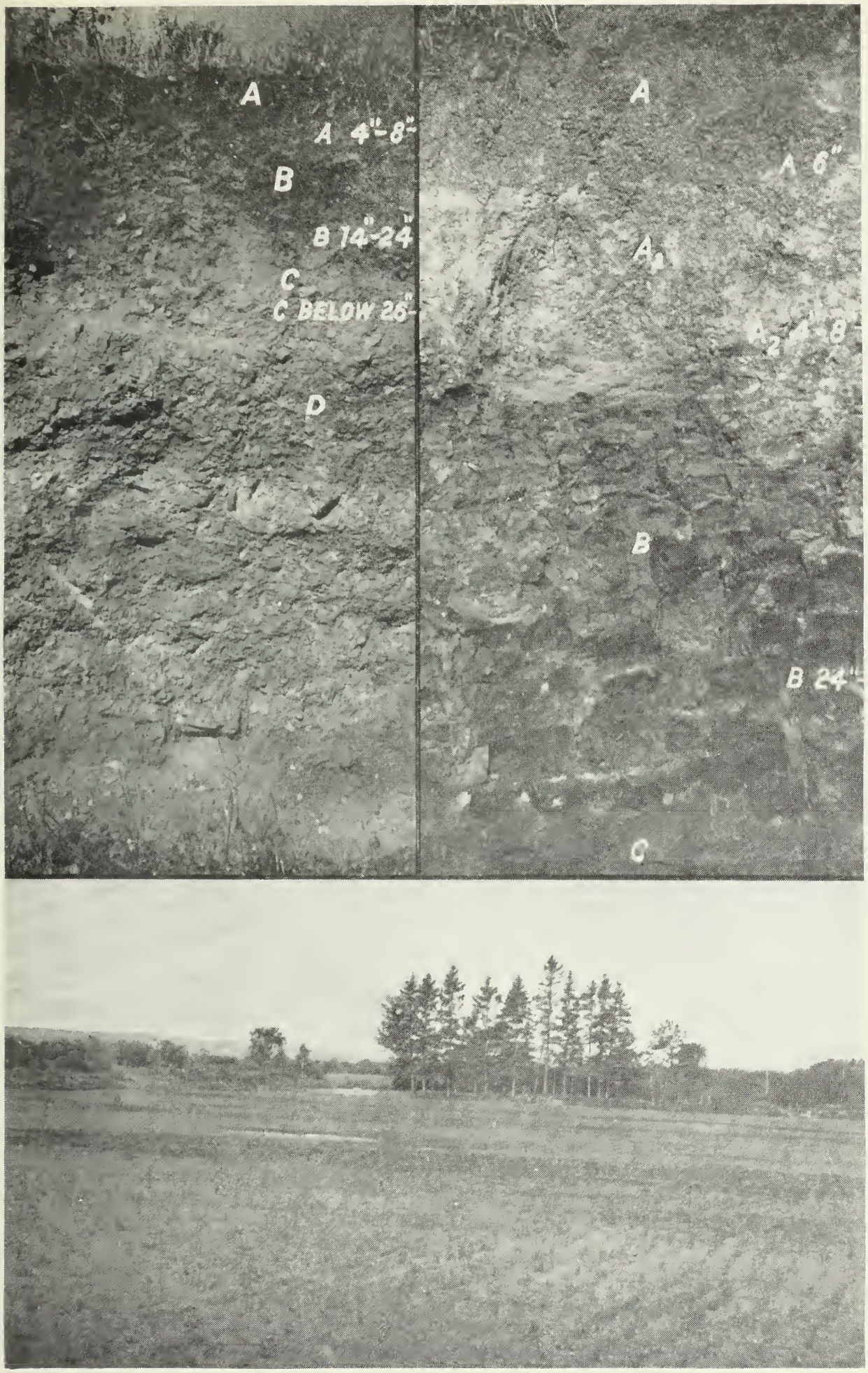

FIG. 9.—Morristown sandy loam, relatively shallow profile to slate.
FIG. 10.—Fash clay loam. Note the structure of the solum, becoming coarser and more massive plastic towards the substratum of "C" horizon.
FIG. 11.—New cranberry bed, developed on a former muck area. Note the sluice gate near the spruce trees. Used for flooding the beds for protection from frost damage.

FIG. 12. Looking north across the Grand Pré dykelands. These level, fertile soils produce excellent grain crops and provide good pasturage in the autumn.

A representative profile description consists of:

A	0″- 8″	Greyish or light yellowish-brown loam; loose, tendency to clod but powders readily.
	8″-12″	Greyish yellow clay loam, slight mottling.
B	11″-22″	Yellowish-brown sandy clay loam, mottled, fair development of a nut-like structure.
	22″-32″	Reddish-brown clay loam to clay, structure not so well defined.
C	below 32″	Reddish-brown clay. Plastic and stiff when wet, brittle when dry.

Falmouth soils, the loam especially, are suited to fruit trees, yields of 150 barrels per acre having been obtained; some of the most extensive and productive orchards being located in the vicinity of Mount Denson and Falmouth. Northern Spys seem to do especially well on these soils.

Around Upper Falmouth, where a block of the heavier clay loam type has been mapped, some highly productive orchards have been developed. As a general rule however, drainage in the heavier soil may prove a significant factor in profitable production. The sandy loam type has not been developed to any extent and is principally in woodland. Although the relief is not suitable for the use of all modern farm machinery, this type offers scope for expansion of orchards.

Falmouth loam and Falmouth clay loam are suited to general farming. They are moderately strong soils and reasonably good cultural practice should produce good crops. Oats, barley, mangolds and turnips are the chief field crops. Oats yield around 45 bushels per acre and turnips around 700 bushels per acre, with mangolds being slightly higher. Corn is grown to some extent as a green fodder crop for dairy cattle. The bulk of the hay is timothy; clover responds to lime and fertilizers, but is not successfully grown without them. Because of the gravelly, more porous character the sandy loam type is not so well suited to hay or pasture as the loam and clay loam.

The sod system of cultural practice is more commonly used in the orchards of the Falmouth soils than is general to the apple-growing region. Falmouth soils, because of their fine texture and topography, are subject to erosion losses. This may explain the increase of gravel from 7 per cent in the B horizon to 19 per cent in the A; and also the decrease of clay from 44 per cent in the B to 21 per cent in the A. Methods of preventing erosion should be followed, otherwise as on some of the steeper slopes in other parts of the Annapolis Valley the A layer will disappear.

WOLFVILLE SERIES

(12,909 acres or 5·2 per cent of total area)

The soils of this series are of medium heavy texture. They occur on the smoothly rounded hills south and east of Wolfville, from Avonport to Hantsport and on the smooth slopes of the terraces south of Coldbrook, just north of Harmony and in the vicinity of Tremont and Torbrook East. They are derived from till deposited over shale and slate.

The general topography is gently rolling with smooth slopes; some areas of more undulating relief have been included. Drainage is fairly well established. The surface, as a whole, has quite good drainage conditions, the general relief being such as to prevent surface accumulation of water. When wet, the heavy texture and plastic nature of the lower subsoil and substratum will retard internal drainage and in wet seasons temporary conditions of poor drainage will be set up.

While fairly free of large stones and boulders, the surface usually contains angular and rounded fragments of slate and shale and some small stones and gravel of igneous rocks.

The surface soil generally is brown to medium dark brown in colour, sometimes with a greyish cast and occasionally a reddish tinge, especially where continued cultivation has depleted the organic matter or the surface and subsoils have been mixed. Where surface cover of forest debris exists, the mineral layer may be more of a yellowish-brown colour. Below this is a soft, loose layer, greyish-yellow in colour, in some cases where the texture is lighter than normal there may be an irregular development of ashy grey material.

The subsoil is brownish-yellow and friable in the upper part. With depth it becomes firmer, light brownish-red in colour and has a structure of nut-like to fine plate-like formation. The structure of the subsoil provides for good root penetration down to the heavier substratum or parent material. Below this is a moderately heavy substratum, brownish-red to red in colour, fairly compact, plastic when wet, but crumbling readily when dry. A greyish cast along the cleavage faces of the soil aggregates is characteristic of these soils.

The subsoil or B horizon is subdivided, the upper part being yellower in colour and more friable than the lower part. In the lighter textured phases the subsurface may be a distinct ashy grey leached layer, particularly in the uncultivated soil. In many places cultivation has resulted in this layer and the upper part of the subsoils being mixed.

A shallow phase has been mapped near Tremont. It is limited in extent, the bed-rock being exposed in places. A characteristic profile description is as follows:—

A	0″ - 8″	Light brown friable loam.
	8″ - 12″	Greyish-yellow to pale brownish-yellow loam, slightly lighter in texture than the surface soil. Loose and friable.
B	12″ - 36″	Light brownish-red sandy clay loam to clay loam; firm, with a nut-like structure, sometimes has a slight yellowish mottling and frequently a greyish cast to cleavage faces of soil aggregates.
C	below 36″	Light brownish-red to red clay. Quite firm to slightly compact, plastic when wet.

The Wolfville series as mapped consists of two types: sandy loam, which occurs as small scattered areas on the higher knolls, and the loam, which is the predominant type and is associated with the smoother slopes and undulating topography.

Gravel makes up 10 to 20 per cent of all horizons; this aids internal drainage. Organic matter is comparatively low. With more attention to organic matter the 20 to 55 per cent of silt and 22 per cent of fine clay will maintain these types as good soils. The moisture-holding capacity is low, being influenced by the comparatively low organic-matter content and the low clay content as compared with other soils of the heavier-textured group.

The acidity, as indicated by a pH of 4·7, shows the soils to be very sour in the surface and upper subsoil, becoming medium to slightly acid in the lower subsoil and parent material, therefore they are in need of lime. Availability tests show that 50 per cent of the surface soils are low in available phosphoric acid, the remainder being fair to fairly high. Tests for available potash show 11 per cent fair and 56 per cent very high. The nitrogent content is fair in the A horizon. More emphasis must be put on increasing the organic-matter content, which can be accomplished by applying lime and phosphate fertilizers in order to promote the growth of clovers.

While considerable areas of the Wolfville soils are under timber, principally second growth spruce, they are suited to both orchards and to general farming. Orchards do well on these soils if care is taken in selecting the sites. In the vicinity of the Wolfville ridge some excellent orchards have been developed. General farm crops produce moderately well on the Wolfville soils, oats yielding 35 to 70 bushels per acre. The principal field crops are oats, timothy hay, turnips or mangolds and some fodder corn. In the Tremont area, where the general texture of the soil is slightly heavier than normal, mixed farming predominates, orchards are scattered and relatively small. A considerable proportion of the cleared and semi-cleared land is grassland and used for pasture.

The extent to which Wolfville soils are utilized for general farming will be limited to some degree by the nature of the topography. While not prohibiting the use of farm machinery as a whole, the relief is such as to make it difficult and expensive to use some of the heavier modern machinery. Erosion losses are liable to lower the productive capacity of these soils unless they are properly handled. The rolling topography and fine texture are conditions that favour erosion processes. The processes are further accelerated when the surface soil is bare, as in orchards, where clean cultivation is practised, or in grassland, where the turf has been allowed to become too thin through over cutting or over grazing.

Poorly Drained Soils on Clay Till

HANTSPORT SERIES

(3,476 acres or 1·4% of total area)

Associated with the Wolfville soils is a group of heavy-textured soils which have been mapped as the Hantsport series. These soils have been developed from till or boulder clay, strongly influenced by Devonian argillaceous sandstones, shales and to some extent slates.

The main areas are situated east of Hantsport and south of Avonport with a few small areas near Hortonville and on the Wolfville ridge.

Hantsport soils occur on the more level and undulating topography, having few, if any, drainage channels. The natural drainage is poor; heavy mottling by reduced iron compounds is characteristic. Stones are rarely encountered in the solum, but scattered boulders occur on the surface and a considerable amount of partially weathered shale and slate fragments is found throughout the profile, especially in the substratum.

The surface soil is dark grey-brown to dark brown in colour, having a fairly good granular or crumb structure. This tends to crumble to a powdery condition and is very apt to bake when dry and puddle when wet. Immediately below the surface is a layer of dull greyish to dull yellowish material, mottled with dark yellow and rusty coloured stains. The subsoil is heavier than the surface soil, firm to compact and dull yellow-brown to dull brown in colour. It is strongly mottled and breaks with a coarse nut-like or fragmental structure. This is underlain by a dull brown substratum that is stiff and plastic when wet. It contains a considerable amount of shale and slate fragments.

Owing to the flatter or smoother topography, the compact nature of the subsoil has a more detrimental effect upon the circulation of air and moisture throughout the soil than does a subsoil of similar clay content in the Falmouth and Middleton series. Root penetration also will be restricted in these soils. During wet seasons the tendency to a water-logged condition in the soil will be injurious to roots. The compact layer may also prevent free upward movement of moisture during dry seasons.

Organic-matter content of the surface soil is fair, but it is more or less inactive on account of the strongly acid condition, as shown by a pH of 4·9 and by the very high lime requirement of 7·4 tons per acre. The reaction of

the parent material is slightly acid to neutral, with free carbonates being occasionally found at a depth of 6 feet or more. This is a very desirable condition to have in the parent material of a soil. However, unfavourable drainage conditions, which cause the soil to be slow to warm up in the spring, hence late to work, as well as restricting root development, and the strongly acid reaction of the surface soil and subsoil, conditions unsuitable for the desirable soil bacteria and other micro-organisms which decompose organic matter, thereby releasing nitrates and phosphates for crop growth, cause the Hantsport soils to have a lower agricultural value than otherwise would be the case.

Total and available phosphoric acid are low, and the low base saturation in the A and B horizons shows a low base content. This deficiency in bases, such as exchangeable calcium and potash, as well as the low phosphoric acid show these soils to have low natural fertility levels.

A good organic-matter content, especially when associated with a high clay content, as in the Hantsport soils, indicates a good moisture-holding capacity. Therefore it is evident that the productive capacity of the Hantsport soils can be increased by proper attention to drainage, maintenance of organic matter through applications of barnyard manure or green manuring crops and by the use of lime and complete fertilizers.

The types mapped in this series are a loam and a clay loam. A profile description of the loam consists of:

A 0″- 6″	Grey-brown to brown loam, has a greyish cast and a fairly well developed crumb structure.
6″-10″	Dull greyish yellow loam, mottled and more cohesive than usual for a leached layer.
B 10″-15″	Dull yellowish-brown loam to clay loam, quite firm, strongly mottled with yellow, green and grey. Also shows a coarse nut-like structure.
15″-27″	Brown clay firm to compact. Coarser structure and strongly mottled.
C below 27″	Dull brown clay, having a dark slate-grey cast. Very stiff, plastic when wet. Contains a fairly high proportion of partially weathered shale and bluish slate fragments. Underlain at variable depths by a greenish-grey shale or bluish-black slate.

Hantsport soils are more suited to grass than most soils of the region. General farm crops, such as oats, buckwheat, field crops and timothy hay, predominate on the cleared land. These crops should do as well on this soil as on most soils of the region provided planting is not delayed by unfavourable seasonal climatic conditions.

Hantsport soils are not suited to orchards, except in the vicinity of Hortonville where the soils of this series merge with and are influenced by the adjacent Wolfville soils. Even in this district orchards are scattered and small in size. Drainage facilities around Hortonville are better than is general for the Hantsport soils.

The greater part of the area mapped in this series is covered by rough pasture or bush. The natural vegetation consists of a second or later growth of spruce, birch, balsam fir, alder, tamarack, aster and poverty grass.

LAWRENCETOWN SERIES

(13,079 or 5·3 per cent of total area)

These are heavy-textured soils derived from the same material as the Middleton Series with which they are closely associated.

Lawrencetown soils occur on the north side of the Valley, mainly between Berwick and Melvern Square and between Middleton and Bridgetown. A few small, scattered areas have been mapped throughout the Valley.

Occupying the relatively flat, low-lying ground bordering the more rolling topography of the Middleton and Kentville series, the Lawrencetown soils have been influenced by material washed down from the higher ground. Drainage is poor, a high water-table is present until late in the season, which restricts aeration as shown by the mottling of the subsurface and limits root penetration. When these soils become dried out the surface soil often becomes hard, very dry and shrinkage cracks occur. Boulders and stones of trap rock and some granite are found on and within the surface soil; gravel within the profile is usually negligible.

The surface soil is brown to dark grey-brown in colour, in some places almost black, where it has a muck-like appearance. The surface of the uncultivated soil often has a fairly good, coarse, granular structure but this is easily destroyed. The soils may become puddled in wet weather and hard and baked in dry seasons. The subsurface is dull grey to greyish-yellow, generally strongly mottled and stained with iron compounds and humus substances.

The subsoil is a yellowish to reddish-brown, heavy-textured material, compact and plastic, very often showing marked mottling. This grades into a redder clay which is usually grittier and not so plastic as the subsoil, containing small stones and fragments of rock material.

Lawrencetown soils, as mapped, contain variations, the soil showing influences from the surrounding soils of the higher ground. In some cases the subsoil will have a higher sand content than usual. North of Aylesford this mixed condition is more marked so that while mapped in the Lawrencetown series, the soils are not so uniform as in other localities.

Two types have been mapped, loam and clay loam. The loam is generally found along the shallow drainage channels and on the rougher ground the profile is more variable than that of the clay loam. A large part of this type is still under young tree growth. The clay loam occurs on the lower smoother plain; it is more uniformly heavy throughout.

Except in the area north and east of Berwick and Aylesford, very little of the Lawrencetown soils is under cultivation; the cleared areas are utilized mainly for rough pasture or hay. In the Aylesford-Berwick locality some grain is grown. The forest growth is chiefly young growth of white spruce, birch and alder, with an undergrowth of ferns, mosses and some bunch grasses.

Although the organic-matter content of these soils is only fair, the moisture-holding capacity is one of the highest of the region; this is probably due to fine texture. The surface soils are strongly acid in reaction, although the parent material is slightly acid to neutral.

A description of a representative clay loam profile is:

A	0″- 8″	Dark greyish-brown to dark brown clay loam.
	8″-12″	Dull greyish yellow clay loam strongly mottled, glei-like.
B	22″-32″	Yellowish-brown, reddish cast, heavy clay loam to clay. Frequently mottled with yellow and grey.
C	below 32″	Reddish-brown clay, stiff and compact, plastic when wet.

Due partly to the high clay and silt content—75 per cent—these soils present all the problems of badly drained soils. Note the extremely low pH—4·5. The C layer has a much higher pH—6·3—as well as a lower lime requirement than the surface. Plant food, as phosphoric acid, nitrogen and potash, especially of the subsoil, is not available; note the low exchangeable potash and total bases. Water has leached away the bases and liming and complete fertilizing are very necessary to maintain humus supply. After drainage, in this series, lime and more organic matter are fundamental.

The compact subsoil maintains a high water-table for a considerable part of the season thus making the Lawrencetown soils unsuitable for orchards. On the more favourable areas where drainage is more easily effected fairly good crops of grain and hay are grown, oats yielding around 40 bushels per acre and hay 1 to 2 tons per acre.

The accessibility of adequate drainage outlets will, in a large measure, influence the development of the Lawrencetown soils.

Well-Drained Soils on Sandy Till

SOMERSET SERIES

(11,609 acres or 4·7 % of total area)

The soils of the Somerset series are very similar to those of the Woodville series. They are generally found associated with them and it is often difficult to define sharp boundaries. They differ from the Woodville soils by having a coarser texture, usually a shallower profile, and a coarser gravelly substratum. (Fig. 3).

Although the topography is level to undulating, Somerset soils generally are well drained; in some cases excessively drained and may even be droughty in very dry seasons. In some depressions and draws, small areas of shallow soil occur in which drainage is slow to poor. As a rule these soils are free from large stones and boulders although a fair amount of gravel is found on the surface and through the profile. The gravel consists mainly of rounded quartz pebbles.

The surface soil is usually darker in colour than the Woodville series, being dark grey-brown or even black. Below this an ashy grey or strongly leached layer generally occurs. The subsoil is yellow, orange-yellow to dull reddish-yellow. Sometimes it has a rusty brown to very dark brown or black colour from the infiltration of organic matter. This horizon frequently becomes indurated, wholly or in part, when very dry.

The substratum is coarse textured and usually quite compact. It often has a shale-like stratification. Although difficult to penetrate the substratum crumbles readily when fractured. The colour is variable, ranging from a brownish or reddish grey, to greenish grey and yellowish colour. The compact nature of the subsoil and substratum does not completely prohibit root penetration but it does restrict to a considerable extent the spread of the finer roots. Some fairly large sized roots penetrate into the substratum. These are often bruised and distorted. While the nature of the subsoil and substratum permits rapid percolation, ensuring good drainage, it tends to interrupt the upward movement of groundwater in dry weather and crops may suffer from lack of moisture.

Two types have been mapped, sandy loam and sand, with gravelly phases of either type. Somerset soils are found around Upper Dyke Village, and Steam Mill Village. A narrow belt extends from Somerset to Weston and other smaller areas occur east of Canning and Kentville; also south and west of Berwick. A profile of the sandy loam type consists of:

A	0″- 6″	Brown to dark brown sandy loam. Fair organic-matter content.
	6″- 8″	Ashy-grey coarse sandy loam, loose and porous.
B	8″-12″	Brownish-yellow sandy loam, loose and containing some fine gravel or pebbles.
	12″-30″	Light brown to brownish-red gravelly sandy loam, quite firm.
C	below 30″	Brownish-red to reddish gravelly loam; compact.

Somerset soils are relatively low in fine soil particles, 25 per cent silt and clay, therefore are not retentive of plant nutrients. This is emphasized by the chemical data (page 79) which show total nitrogen, total and available phosphoric acid and exchangeable potash to be low in the uncultivated soil. Soil studies made on a considerable number of orchard surface soils show available phosphoric acid and potash to be fairly high which confirms field observations that Somerset soils will respond to careful management. Although lime requirement is low, the strongly acid condition of the profile, as shown by a pH of 5·2 or less, and the low exchangeable base content indicate the need of basic material as lime, neutral fertilizer or slag. Another important factor in the management of these soils is the maintenance of the supply of organic matter which at 4·5 per cent is only fair.

Somerset sandy loam occupies the smooth, or nearly level topography west of Somerset and north of Upper Dyke Village. It is not so coarse or porous as the sand which occurs on the crests of smoothly rolling relief. The cleared areas are extensively used for orchards, producing yields nearly as large as those of the Woodville sandy loam, but not so uniformly high, because of the greater tendency of the soil to become dry. General crops, such as oats, potatoes, field roots and hay, mainly timothy (lime being necessary for satisfactory clover crops) can be successfully grown.

In seasons of ample rainfall during June and July and when liberal applications of commercial fertilizer are used, oats yield 45 to 50 bushels or more per acre. The general average, however, is nearer 30 to 35 bushels per acre. The smooth relief permits the use of modern farm implements, and the ready absorption of rainfall by the surface soil allows cultivation very shortly after rains.

The sand type is not so productive a soil. The coarser texture of the soil mass and consequent lack of drought resistance are factors that lower the agricultural value of this type. A large percentage of the sand type is under scrub spruce and wire birch bush. Orchards are scattered and unthrifty in appearance, general farm crops are not so productive as on the sandy loam.

The natural fertility of the Somerset soils is only fair but the productive capacity can be materially increased. One of the most important factors in this respect will be the preservation of adequate moisture conditions through the building up of the organic-matter content of the soil. This can be done by the use of mulch and green manuring crops and by the adoption of a short-rotation system of farming.

Applications of lime and the judicious use of commercial fertilizers will also be necessary for most satisfactory yields, not only of apples, but for field crops as well.

WOODVILLE SERIES

(13,848 acres or 5·6% of total area)

The Woodville soils consist of light to medium-textured soils derived mainly from sandstone material. These soils are found north of Somerset, around Kinsman's Corner or Woodville, extending to Centreville, with smaller areas in the vicinity of Canning, Hillaton, Medford and Port Williams.

The topography is undulating to gently rolling. Natural drainage courses and the general relief provide for adequate surface drainage, while the structure and texture of the subsoils permit free underdrainage. On some of the higher knolls drainage may be excessive. Large stones or boulders are rarely encountered; quartz, pebbles, smoothly rounded gravel, and some platey fragments of sandstone occur on the surface and throughout the soil mass.

The surface soil is greyish or yellowish-brown to brown in colour, occasionally having a slight reddish cast. Under good management it may have a dark colour and a soft crumb-like structure. A leached, light or ashy grey to whitish subsurface layer frequently occurs. Below this the subsoil consists of a loose, friable layer, brownish to reddish-yellow in colour and without any definite structure. This is followed by a reddish-brown, firm to compacted gritty soil having a weak plate-like structure which crumbles readily upon being broken. (Fig. 7.)

The substratum is quite firm to compacted and gritty. Like the lower part of the subsoil it crumbles readily, being only weakly cemented. It is reddish-brown to reddish in colour, often having a purplish tinge. When an exposed face is smoothed down it will frequently have a greyish stippled effect, also a weakly bedded or stratified appearance. The texture is more variable than is common to most soils of the region.

Between Lakeville and Centreville the texture is lighter throughout the soil mass than is general for the type, particularly on the more rolling or ridge-like topography. On the smoother relief just north of Kinsman's Corner, along Church Street and around Medford where the Woodville soils merge with the heavier soils of the Kentville and Pelton series, the subsoils tend to be heavier than normal.

Woodville sandy loam is the only type mapped. A general profile description consists of:—

A	0″- 8″	Greyish-brown to light brown sandy loam, loose, single grain structure.
	8″-14″	Ashy grey sandy loam, loose, powdery.
B	14″-24″	Reddish-yellow sandy loam; loose and fairly mellow. Single grain to structureless.
	24″-50″	Reddish-brown or brownish-red sandy loam—quite firm but friable. Has a weak platy structure and contains fine quartz pebbles giving it a gritty feel.
C	below 50″	Grades into a redder loam to sandy clayey loam containing pebbles and fine gravel. Quite firm to compacted, crumbles readily when fractured, and has a greyish cast.

In the area around Centreville the B_1 horizon is occasionally slightly indurated, owing probably to infiltration of finely divided organic matter or humus. The relatively coarse texture of the subsoil will allow a freer downward percolation of water than occurs in soils with a finer textured and heavier subsoil, such as the Kentville and Wolfville series. While this condition assures rapid drainage, it also facilitates the removal of plant nutrients from the upper layers through leaching.

Woodville sandy loam is a mellow and friable soil, provides a good medium for the development of plant roots, and is easily cultivated. Its relief is such that modern farm machinery can be used satisfactorily. Owing to the porosity of the soil mass, intertilling is possible within a relatively short time after rain.

The chemical data show the total nitrogen, total and available phosphoric acid all to be low, which combined with the strongly acid reaction, pH 4·8, the high line requirement and low exchangeable bases indicates low natural fertility in these soils. However, practical experience and the study of many cultivated

soils proves that the productive capacity can be materially increased under good management. The organic matter in the uncultivated soils compares favourably with most soils of the Valley, being around 7 per cent, but under orchard cultivation has been reduced to around 4 per cent. Further, the wide C:N ratio 19·5 and low total nitrogen suggest that where the soils are so strongly acid, conditions are not favourable for the decay of organic matter. To maintain and increase yields it will be essential to supply organic matter, preferably in the form of barnyard manure or a green manuring crop such as clover.

This soil is considered to be one of the most desirable orchard soils of the region. Moisture supply is not so serious a problem as on some of the other soils of the Valley. The physical nature and natural relief of this soil assure a moderately good moisture-holding capacity, while the penetrability of the soil mass allows roots to reach into the lower depth for a reserve water supply.

Practically all the land is cleared and under cultivation. Having been recognized as a suitable orchard soil, the greater part of this type is now planted out to apple trees. A number of high producing orchards have been developed. Some dairying but mostly general farming is carried on in conjunction with the orcharding. The main forage and fodder crops are oats, roots and mixed timothy-clover hay. Good yields of oats can be obtained when commercial fertilizers are used, yields having reached 55 to 70 bushels per acre. To obtain a satisfactory stand of clover, particularly red clover, applications of manure and lime will be necessary.

Woodville soils are well adapted to potato growing, both for certified seed and table stock. This crop has been grown on a commercial scale for a considerable number of years, the acreage fluctuating according to the profits obtained. While orchards and field crops are generally well managed, careful attention will have to be paid to the maintenance of an adequate supply of organic matter. Very few orchards are in sod, although fairly heavy stands of cadlock or wild radish are allowed to grow in the orchards, later being ploughed down. In some cases cover crops are ploughed under.

Because of the strongly acid conditions Woodville sandy loam is not a good grassland soil and pastures will not stand continuous grazing. They should be renewed in a system of rotation cropping or receive periodic top dressings with lime and fertilizers high in phosphorus. Otherwise the herbage will deteriorate and the desirable grasses and clovers will be crowded out by such plants as poverty grass, paint brush, sorrel and other weeds.

The natural tree growth, which is a second growth or later stand, is typical of the medium-textured soils of the region, spruce, birch and poplar. Natural grasses are generally Kentucky blue grass and poverty grass.

BRIDGETOWN SERIES

(979 acres or 0·4 per cent of total area)

The soils mapped as the Bridgetown series comprise one of the smaller groups of soil, occurring only between Bridgetown and Granville Centre, along the slope at the base of the South Mountain. They are relatively coarse in texture, being derived from parent material mainly influenced by granite rock material. In this respect Bridgetown sandy loam, the only type mapped, is similar to two other soil series, Annapolis and Prospect, which will be discussed later.

Occurring along the margin of the Valley proper and the lower slope of the South Mountain the topography is undulating to gently rolling, with a general northerly slope. Granite cobbles and boulders are found in variable quantity on the surface, in places having been quite plentiful as shown by stone piles along fence rows. Gravel is present throughout the profile, increasing in quantity with depth.

Surface drainage is adequate, in some cases quite rapid, the gravel content of the subsoil ensuring free downward movement of water hence good internal drainage. Because of the ease with which water percolates through the soil and the comparative shallowness of the soil to a compacted substratum, this soil type is apt to be droughty.

The surface soil is dark grey-brown to brown in colour, has a tendency to a weak pulverulent structure. This is readily destroyed by improper management and the surface soil is apt to bake or become crusty. Below this surface layer is a subsurface horizon of white or light greyish, loose sand or loamy sand. Development is irregular, and as in the case of most soils of the Valley region clearing, logging, cultivation and activities of settlement in general have tended to mask or destroy the A_2 layer through mixing with the other layers.

The subsoil is generally a deep yellow to reddish colour, porous and containing an appreciable amount of gravel that is smooth, subangular in shape. This is underlain by a compacted gravelly to stony substratum. A representative profile description consists of:

A	0″10″	Greyish-brown sandy loam, weak development of structure, friable.
A_2		Traces of ashy grey or white loamy sand, loose and porous.
B	10″-14″	Yellow-brown sandy loam, contains some gravel, loose, mellow.
	14″-22″	Yellow-brown, gravelly, coarse sandy loam, having a slight rusty-red cast, loose, porous with little or no definite structure.
C	Below 22″	Dull brownish-red gravelly to stony sandy loam, quite compact but not impervious. Rock material mainly granite.

Due to the gravelly, porous nature and relative shallowness of the profile, moisture conditions in the Bridgetown soil will greatly influence crop production, hay and pasture fields turning brown and having a bare appearance in long dry periods. Attention to the maintenance of a satisfactory organic-matter supply is essential. The chemical data indicate that this soil has only fair organic-matter content, about 4 per cent. Barnyard manure or a green manuring crop, such as clover, are very desirable sources of organic matter, especially where the natural organic matter present is relatively inactive, as shown by the wide C:N ratio, 17·7, which indicates a low nitrogen content.

Total and available phosphoric acid are very low; soil reaction throughout the profile is medium acid, as shown by a pH of 5·9 and lime requirement of 2 tons or less per acre.

A considerable proportion of the Bridgetown sandy loam soil is undeveloped rough land or is used for pasture. Where under cultivation, the main field crops are oats, barley and timothy hay. Orchards are not so extensive and do not appear to be so thrifty as those on some of the soil types of similar texture.

BERWICK SERIES

(10,354 acres or 4·2% of total area)

The Berwick series comprises medium-textured gravelly soils. They are developed from a slightly modified till derived mainly from igneous and sedimentary rock material, presumably of the Triassic and Devonian periods. They occur along the lower slope of the South Mountain, extending from Torbrook Mines to Cambridge Corners, also on the smooth ridge in the vicinity of Berwick, and some small isolated areas toward Wolfville.

The topography is undulating to gently rolling terrace, or ridges. Drainage is well established except in the more level to undulating areas occupied by the heavier type, where drainage is slower. Boulders and large stones are not a serious factor; smoothly rounded and subangular gravel and cobbles of granite, quartzite and slate with some amygdaloid and sandstone fragments occur on the surface and frequently throughout the profile.

The surface layer is brown to dark grey-brown in colour and has a granular to weak crumb-like structure. Under cultivation, the colour may be light or even yellowish-brown and the structure destroyed, chiefly through lack of organic matter. Below this a whitish or light or ashy grey, lighter-textured layer may be irregularly developed.

The subsoil is yellow-brown to reddish-brown in colour; it is generally loose and friable in the upper part becoming firmer with depth. Sometimes the lower subsoil becomes quite compact with a weak development of a nut-like structure.

The substratum is brown in colour with a greyish or reddish cast, very often quite compact and gravelly. Profile development is variable; the ashy-grey subsurface layer may be absent, developed as a thin layer or as small pockets. Variations in thickness and degree of differentation of the subsoil occur.

The till, although compact in places, is not impervious to water penetration and root development generally is quite satisfactory. The following description of a sandy loam profile is fairly characteristic:

A	0″- 6″	Light brown to brown gravelly sandy loam, structureless and loose. Traces or pockets of ashy grey, leached sandy loam, loose.
B	6″-16″	Brownish-yellow to reddish-yellow, gravelly, sandy loam, loose, with little or no structure.
	16″-34″	Brown to reddish-brown or brownish-red, gravelly sandy loam. Quite firm.
C	below 34″	Greyish-brown, gravelly sandy loam. Firm to compact.

Berwick soils, as mapped, consist of sandy loam and loam types. The surface soils compare favourably, as regards clay content, with some of the heavier-textured soils, such as Middleton loam, Falmouth sandy loam and Kentville sandy loam. This comparison does not continue into the subsoils, the Berwick soils being slightly lighter textured and more gravelly, giving a more friable constitution. The compacted condition of the substratum is probably due to mode of deposition.

Analytical data (page 81) show these soils to have only a moderate amount of silt and clay, 30 per cent, which taken with the relatively low organic matter, about 4 per cent, indicates the moisture-holding capacity of Berwick soils to be only fair. Practical evidence of this is to be seen in very dry seasons when the trees and crops show signs of wilting. The relatively high gravel content in the surface soil provides a certain amount of protection from surface wash or erosion, while that in the subsoil assures adequate drainage. The soil reaction is strongly acid throughout the profile, surface soils having a pH of 5·2 and subsoils around pH 4·9. High lime requirement and a low base saturation, 45·6 per cent indicate that bases have been leached out and must be supplied.

Although the total nitrogen, and total and available phosphoric acid in the uncultivated soils are low, spot tests in numerous orchards have shown they can be increased to a fairly high level, which with the moderately high available potash levels found in these soils, increases their productive capacity. These results confirm field observations that while the natural fertility of Berwick soils is only fair, they will respond to good management.

The sandy loam is the predominant type. It is well suited to orcharding and is mainly utilized for this type of agriculture. The nature of the topography and the gravel or stone content of the surface soil, while not prohibiting the use of all modern farm machinery will increase the cost of operation. Some general crops are grown but the above mentioned features and the porous character of the profile make the sandy loam type better suited to orcharding than to general farming. Poultry raising and strawberry growing are two other sources of revenue that are being developed on this soil type.

Small areas of Berwick loam are mapped south of Berwick and south of Greenwood. The relief is smoother than that of the sandy loam and drainage is slower. The subsoil is slightly heavier in texture than the sandy loam and the soil colours are usually duller in cast; occasionally a slight mottling occurs. A mixed spruce-birch-poplar vegetation covers the greater proportion of this soil type. A few scattered orchards have been planted, but they have not the thrifty appearance that is found in the orchards on the sandy loam type. South of Greenwood a large part of the cleared land is used for meadow and hay land.

MORRISTOWN SERIES

(10,065 acres or 4·1 per cent total area)

The soils of this series belong to the medium-textured class of till soils which have been influenced mainly by Devonian slate rock material. In many places the till is thin and the profile shallow, often resembling a residual or feebly modified residual soil. (Fig. 9).

Morristown soils occupy the more level terraces at higher elevations about 300 to 400 feet, and the adjacent gentle slopes of the South Mountain. The principal area extends from Kentville to Harmony, with smaller areas on the Wolfville Ridge, south of Wolfville and on the crest of the high ridge, southwest of Nictaux Falls.

The general topography is sloping to rolling. Surface and subsurface drainage are well established over most of the series, but there are depressed draws and lower slopes where seepage from higher levels and springs keeps the soil saturated for long periods. A considerable number of morainic boulders occur on the surface, angular slate fragments and a small admixture of sandstone and amygdaloid also occur on and in the surface soil. The substratum contains a high percentage of slate fragments.

The surface layer is grey-brown in colour, mellow and has a fairly good crumb structure. Occasionally a whitish-yellow to pale yellow subsurface layer is developed, more especially on the lighter-textured types. The subsoil is slightly heavier in texture than the surface layer, reddish-yellow to light reddish-brown in colour and frequently firm and having a crumb structure. The underlying substratum is variable, ranging from a sandy loam to clay loam with a high percentage of slate fragments.

Both surface and subsoil are of fairly good structure, forming a good medium in which to grow crops. The depth of the profile is variable, ranging from 18 to 48 inches, and the nature of the underlying slate fragments varies from small, soft chips to harder and flintier material, in places bed-rock outcrops at the surface. The variation in depth of profile fluctuates within narrow limits so that it was not possible to make a separation between shallow and deep phases.

The Morristown soils are fairly well supplied with organic matter, being among the best in the region. They are strongly acid throughout the profile, and while the moisture capacity in general is fairly good, the nature of the parent material and the close proximity to the surface in some places, of the bed-rock may result in the soil being droughty in very dry seasons. This condition is more marked on the higher areas west of Nicholsville. Three types have been

mapped in this series. The sandy loam, just south of Factorydale, is a relatively shallow soil, quite gravelly, and having indications of the development of a leached layer. The clay loam occurring mainly between Harmony and Nicholsville is also a shallow soil, the substratum consisting of coarser and more angular slate fragments than the sandy loam, and variable in texture, often having a fairly high clay content. The loam is the most extensive and important of the three types. On it most of the commercial orchards on this series are planted. It has, as a rule, a deeper profile than either of the other two types, the subsoil frequently showing some separation.

A description of an uncultivated Morristown loam profile is as follows:

A 0″ to 6″ Greyish or light brown loam, mellow, quite gravelly to stony; mainly angular and platy fragments. Occasionally underlain by a whitish or greyish-yellow subsurface layer. Lighter in texture, loose and friable.

B 6″ to 30″ Yellowish-brown to light reddish-brown sandy loam to loam; stony and porous.

C below 30 Brownish sandy loam to clay loam. Contains a high percentage of coarse slate fragments.

The natural fertility of the Morristown soils is fair to moderately good and the producing capacity compares favourably with other medium-textured soils and also with the heavier-textured soils of the region. The chemical data show the total and available phosphoric acid and the exchangeable potash in the virgin soil to be low, which means that if fertility is to be maintained or increased, regular applications of manure and fertilizer are necessary. This has been proved in orchards where soil tests have shown both total and available phosphoric acid to be high and some increase in exchangeable potash.

Total nitrogen and organic matter are high (0·3 per cent and 10 per cent respectively) in the virgin soil but the wide C:N ratio indicates that nitrogen in the available form, as nitrates, may be limited because of slow decomposition of the organic matter. Applications of lime and the use of nitrogenous fertilizers will prove beneficial.

As previously stated, these soils are strongly acid, as shown by the pH of 4·4 to 5·3 and the high lime requirement, 7·4 tons to 4·2 tons in the surface soils and 2·4 tons in the parent material. The exchangeable hydrogen also is high. Lime is essential to overcome this undesirable condition; the experience of farmers has shown that where liberal applications of lime have been used, alfalfa can be grown.

While from 40 per cent to 80 per cent of the whole soil mass of all horizons consists of gravel and 45 per cent of the soil after the gravel has been removed, is sand, the remaining 55 per cent of fine material enables the soil to retain plant nutrients and offset the tendency of the coarse material to permit too rapid leaching.

Morristown soils are adapted to orcharding, more especially the loam and sandy loam. General farming, in association with dairying in the way of cream production, is a major agricultural activity on these soils, particularly the loam and clay loam. On some farms apple growing is the principal source of income, and on other farms, a combination of orcharding and general farming is followed. Some excellent orchards have been developed on the Morristown soils, especially on the loam around the settlement of Morristown, good quality and very satisfactory yields having been obtained, running in some orchards as high as 200 barrels per acre. Oats, field roots and timothy hay are the principal field crops. Under favourable conditions and good cultural practices, oat yields as high as 70 bushels per acre have been obtained, with a general average of around 35 to 40 bushels per acre. Strawberries also do well on the lighter

types. The prevalence of springy places, especially on the lower slopes, interferes with the uniformity in spring planting operations, so that grain fields are apt to be patchy and yields reduced.

Imperfectly Drained Soils on Sandy Till

ANNAPOLIS SERIES

(1,754 acres or 0·7 per cent of total area)

Occupying a narrow belt of sloping topography extending from Round Hill to Annapolis Royal is a soil of medium heavy texture developed from till derived chiefly from granite rock material. Although the topography is irregularly sloping, providing fairly rapid surface drainage, the subsoil is heavy enough to slow the downward movement of water, resulting in an imperfectly drained soil that is relatively slow to warm up in the spring.

The surface often carries a heavy pavement of granite boulders (Fig. 5) which will be a handicap in the clearing of these soils. Gravel in varying quantities is found in the profile, consisting principally of granite and other igneous pebbles, fairly smooth and rounded. This suggests that these soils may have been subjected to some modification by water action.

The surface soil is brown in colour, frequently has a greyish cast and a pulverulent to crumb-like structure. Immediately below this, traces of an ashy-grey, friable subsoil may be found. The subsoil, heavier in texture than the surface soil, is brown to dull brown or drab in colour. In the upper part it has a yellower cast, and is more friable than the lower part of the subsoil. The gravel content of this layer is variable, being quite significant in some places. Below this the soil grades into a drab, mottled substratum, usually fairly heavy in texture, although it sometimes contains a fairly high amount of gravelly and coarse sandy material.

The lower part of the subsoil and the substratum occasionally have a variegated or mottled colour, greenish-yellow and grey, resembling in this respect the soils of the Hantsport series. Only one type has been mapped in this series, Annapolis sandy loam. A general description of the profile is as follows:—

A 0″— 8″ Brown sandy loam, mellow and friable, some tendency to a crumb-like structure. Below this traces of a leached or light greyish layer are sometimes found.

B 8″—12″ Yellow to yellowish-brown sandy loam; loose, friable with more or less of a pulverulent structure.

12″—30″ Brown to dull reddish-brown loam to clay loam, no definite structure but some indication of a weak, nut-like development is occasionally seen. Tends to be plastic when wet; contains some gravel.

C below 30″ Drab or dull grey brown sandy loam to sandy clay loam, firm to compacted and showing some mottling.

The heavy texture of the lower subsoil while not totally impervious impedes the downward movement of groundwater, as indicated by the variegated colouring. Consequently, internal moisture conditions are unsatisfactory and air circulation within the soil is limited. Both of these conditions tend to restrict root development.

Annapolis sandy loam has only fair ability to hold moisture and plant food, since it has only 7 per cent clay, 25 per cent silt and 3 per cent of organic matter in the surface soil. Barnyard manure and green manuring crops must be used for their humus value. A pH of 5· and an extremely low phosphoric-acid content, especially available phosphoric acid, would warrant the use of one

or possibly two tons of limestone and 400 lbs. of superphosphate per acre. As total nitrogen and exchangeable potash also are only fair, and because of the low clay content, a complete fertilizer such as 5-10-5 should prove beneficial.

With the exception of directly southeast of Annapolis Royal, around Mochelle and in the vicinity of Round Hill, very little of the land is cleared. General farming predominates, the main crops being oats, barley and timothy hay. Yields average around 30 to 40 bushels of grain per acre when moderate amounts of fertilizer are applied. Hay yields of 1 to $1\frac{1}{2}$ tons per acre are obtained. Applications of lime would improve the clover stands, thus increasing yields and improving quality of the hay crop. This soil type is suitable for grassland and with reasonable management should provide some good pasture land.

Apple orchards are scattered and relatively small in extent, although some of the plantings are quite old. Cherries are also grown in this district and do fairly well.

Soils on Water-Laid Parent Material

Occupying approximately 33·6 per cent of the total area surveyed, the soils developed on water-laid parent materials comprise what might be termed the lighter-textured soils of the region. They are found along the floors of the Annapolis and Gaspereau Valleys as marginal terraces bordering the glacial till soils, and along the smaller river courses.

Included in this grouping are soils derived from stratified glacial materials deposited by glacial and post-glacial rivers and streams. They are, except for one series, loose, porous, sandy soils underlain by sandy to gravelly parent materials. The one exception is a clay soil derived from what appears to be a marine or estuarine clay. Surface soils on the uncultivated areas are relatively dark coloured, ranging from brown through dark greyish-brown or dark brown to black. Subsoils are light coloured, yellow, yellowish-brown to reddish-brown, while the substrata vary according to the rock material predominating.

Eleven soil series have been developed from these water-laid materials. Canning, Cornwallis, Gaspereau, Nictaux and Avonport soils are derived from sandy and gravelly materials of the smoother river terrace deposits along the Valley floor. The Pereau, Prospect and Torbrook series are well-drained gravelly soils on hummocky, ridge-like or older terrace topography. Others are the Miller series comprising poorly-drained soil occurring along old watercourses, depressions and drainage basins associated with the higher topography; the Fash series derived from a marine clay; and recent stream alluvium or bottom-land.

The general texture and structure of these soils permits the ready absorption of rainfall and the rapid percolation of excess water through the soil body in all except the Fash and Miller series. The clay nature of the subsoil of the Fash series slows the internal drainage in this soil, while the position and seepage affect the groundwater level in the Miller soil.

Surface soils of the well-drained series are easy to work and dry quickly after rains. The porous nature of the subsoils facilitates aeration, oxidation and strong leaching processes. The working and reworking of the parent materials by water action has removed large quantities of the natural base content which was probably not very high originally.

In some of these lighter-textured soils there is a tendency to a hardpan formation through the accumulation of iron and alumina compounds or organic colloids in the subsoil. This is more marked in soils where drainage and evaporation are very rapid and the deposited materials become more or less desiccated and hard.

The natural fertility of these light-textured soils is lower than that of the other soils of the Valley. Moisture supply will also be an important factor influencing their productive capacity. Because of their inherent characteristics, these soils are not grassland soils, nor are they well suited to general farm crops. They are better suited to specialized crops, crops for which the available markets will warrant the expense of the intensive cultural practices necessary for satisfactory production on the light-textured soils.

The heavier texture of the Fash series gives these soils an advantage over the other water-laid soils, in natural fertility and moisture-holding capacity, in suitability for grassland and general agriculture. Because of their fine-textured surface, erosion may become a problem on these soils.

An important factor to be considered in the utilization of the soils of the Cornwallis and Nictaux series, particularly, is frost hazard. The main body of these two series lie within the frost area along the Valley floor.

Well-Drained Soils on Sandy Parent Material

CORNWALLIS SERIES

(29,768 acres or 12·1 per cent of total area)

This is one of the most extensive groups of soils in the Valley. Cornwallis soils occupy large areas of the Valley floor along the Cornwallis and Annapolis Rivers. They are light-textured soils developed on undulating to gently rolling topography from sandy parent material of mixed origin, sandstone, trap, granite and other igneous material.

Drainage is rapid to excessive, the porous nature of the soils permits rapid absorption and free downward movement of rainwater. In dry seasons excessive drainage may result in an arid condition of the soil. Smooth, water-washed gravel and pebbles occur on the surface in varying quantities, some pebbles may be found in the subsoil. Occasionally the substratum will contain noticeable amounts of gravel in the form of pockets or lenses. Cornwallis soils are, however, relatively stone-free.

The surface layer consists of loose porous sand or sandy loam, grey-brown, dark grey-brown to dark grey or black in colour, having a single grain structure, and varying in thickness from 4 to 8 inches. Below this is a leached ashy grey or white subsurface layer, from a small remnant to 12 inches in thickness and quite loose and porous.

The subsoil is a yellow to brownish-yellow in colour which may grade at from 8 to 14 inches into a browner colour. It is sand to light sandy loam in texture, and firmed or packed, single grain structure and porous. A separation of the subsoil is not always possible, the graduation being so slight. Sometimes the upper part of the subsoil may become indurated or of hardpan formation. This condition is not so common as in the Nictaux series. Below 36 to 50 inches it becomes lighter in colour, being more of a yellow, light yellowish-brown or light brown tint with greyish or yellowish cast. Lenses or bands of fine gravel and coarse sand may be seen with stratification becoming more distinct with depth. Gravel is present in varying amounts throughout the profile, but is seldom in any quantity within five or six feet of the surface, except in the gravelly phase.

Under forest conditions the surface layer consisted of a mat of pine needles over a well developed greyish or white layer. Practically all this land has been cut over and cleared; in areas of second growth woodland, a thin mat of needles is occasionally found, below this there frequently is an incipient A_1 development (Fig. 6). The first two or three inches of the grey layer are darkened by humus leached from the slowly decomposing organic layer. Sometimes the B horizon

is indurated to form a hardpan. This may occur in the upper part of the subsoil and sometimes in the lower part, depending upon the depth to which the cementing materials, either finely divided humus particles, or iron compounds, have been leached.

All horizons are strongly acid in reaction, pH 4·5, the solum being more strongly acid than the substratum, where the acidity is irregular, ranging from strongly acid to medium acid. The organic-matter content of Cornwallis soils is, like that of the other light-textured soils, low, being slightly lower than that of the Canning soils. These soils are also lacking in fine clay particles, consequently the natural moisture-holding capacity is low.

Cornwallis soils differ from the Canning series in having more of a brownish or greyish-brown subsoil and substratum and somewhat coarser texture, not being so mellow or soft. They differ from the Nictaux series by reason of a deeper profile to the gravelly material of the substratum. The light texture and porous nature permits the rapid downward movement of rainfall and soluble nutrients, also rapid drying out of the solum so that the moisture conditions will be a limiting factor in crop production. These unfavourable conditions may, in part, be offset by deep root penetration. Two types and a gravelly phase have been mapped, Cornwallis sand and sandy loam. A profile description of Cornwallis sand, which is the most extensive type, consists of:—

A	0″– 6″	Dark grey sand, structureless, loose and quite porous.
	6″–12″	Light ashy grey to white sand, coarser than A; loose and quite porous. Irregular in development, appearing as pockets and tongue-like intrusions into B horizons.
B	12″–24″	Deep yellow or brownish-yellow sand, more coherent than A_2
	24″–36″	but quite porous. Single grain structure, grading into a finer yellowish-brown to brown fine sand, firmer than the upper part.
C	below 36″	Paler coloured sand, when wet has a greyish-yellow cast, but when dry browner in colour. Weakly stratified below 4 feet. Some fine pebbles and gravel.

Cornwallis sand is coarser textured throughout the profile than the sandy loam. Although the subsoil may, in places, be indurated the soil generally is very porous, has little cohesion when wet and when dry is incoherent as it contains little fine clay material to act as a binder. It is liable to excessive leaching and tends to be arid during the dry season of the year. A slightly higher content of fine clay particles in the subsoil is apparently sufficient to give the sandy loam a slight advantage in moisture-holding capacity. The subsoil is also a little more cohesive, packy or firmer than in the sand, although still quite porous.

The analytical data show the amount of gravel varies from 3 per cent, the average for all horizons of the sandy loam to 27 per cent in the gravelly sandy loam. Sand content varies from 90 per cent in Cornwallis sand to 70 per cent in the sandy loam and the clay content varies from 2 to 7 per cent respectively. These conditions favour extreme leaching and destruction of the organic matter.

Based on the per cent of nitrogen (·03 x 20) the organic matter is 0·6 per cent in the sandy loam which is extremely low. If based on percentage of carbon (2·63 x 1·75) the organic matter is 4·6 per cent. This wide difference may be accounted for by the presence of charcoal as a result of the burning of the vegetative covering. While this may be a quick and economical way of clearing the land of a rank growth of grass, scrub trees or stumps from forest growth, it is an unsound practice agriculturally, as it destroys what little organic matter there is in the surface soil, causing a considerable loss of plant nutrients which will require a considerable number of years of soil management to build

up. Virgin soils of this series are particularly low in total and available phosphoric acid and exchangeable potash. Heavy fertilizer application in orchards on Cornwallis gravelly sandy loam increased the exchangeable potash from 0·08 M.E. to 5·9 M.E. as shown by the average of five samples of surface soil, indicating that although the natural fertility is low, these soils will respond to good management.

Because of their extent, the Cornwallis soils are important in the agriculture of the Valley. Most of the land has been cleared and brought under cultivation at one time, but a considerable proportion of it is now reverting to scrub pine, spruce, birch, aspen and such low growing bushes as blueberry, sweet fern, brown crowberry, Hudsonia and leather leaf. The grasses are chiefly wild oat grass *(Danthonia spicata)* and poverty grass *(Panicum depauperatum)*.

On the cultivated areas oats, timothy, and mixed clover and timothy hay as well as some field roots are grown for the farm animals. Stands are usually thin and yields low, oat yields ranging from 20 to 25 bushels per acre to 35 or 40 bushels when liberal amounts of commercial fertilizer are used. Under favourable conditions of sufficient rainfall and good management, hay yields are usually around 1 ton to 1½ tons per acre. Grazing is poor, the grass cover being wiry, thin on the ground and of poor quality. During the dry season the herbage becomes wilted and turns brown in colour.

While the total acreage of Cornwallis soils that have been planted to orchards is considerable, the orchards are not very extensive nor so well developed as those on the heavier types of soil. Although yields of around 107 barrels of apples per acre have been obtained under the conditions of intensive cultivation and very careful management, the general average over a period of years would be nearer 60 barrels per acre. Invariably orchards on the Cornwallis soils have proved to be unprofitable so that there is very little, if any, new planting taking place.

Specialized crops, such as early truck crops that require a relatively short growing season offer possibilities on these soils, provided special attention is given to the maintenance of adequate moisture conditions through an abundant and constant supply of organic matter and the use of irrigation, as well as liberal applications of fertilizers. The extent to which such a type of agriculture can profitably be developed will be regulated by accessibility of remunerative markets. Under present economic conditions Cornwallis soils are marginal agricultural soils.

Another factor influencing the agricultural value of these soils is the frost hazard. Extending along the Valley floor Cornwallis soils lie within the frost belt of the region.

CANNING SERIES

(5,932 acres or 2·5 per cent of the total area)

Canning soils are similar in many respects to the Cornwallis soils. They are light-textured, porous soils, developed from water-laid deposits. Canning soils differ from those of the Cornwallis series in being softer, and mellower throughout, also by having a browner or more reddish cast to the colour of the substratum. They are developed from incoherent sandy deposits carrying the influence of fine grained shaley sandstone and North Mountain trap rock material.

These soils occur principally around Melvern Square, south of Lakeville, and north of Sheffield Mills. Other areas included are along Porter's Point, and near Wolfville—the latter being not quite typical. They usually occupy smoothly to gently rolling topography. The natural relief, proximity to drainage courses, and the permeable nature of the soil mass have resulted in a well-drained soil. In some places, as on sandier and higher knolls, drainage may prove excessive.

Rocks and boulders seldom occur on the surface; some fine, smoothly rounded pebbles may occur in the profile but the soil generally is comparatively free of stones or gravel.

The surface layer, where remnants of woodland remain, consists of a thin mat of pine and spruce needles underlain by one to three inches of a black organic material. As most of the land has been cut over and cleared, the surface soil is usually greyish-brown to brown in colour, a little lighter in colour than Cornwallis soils, loose, mellow and from six to eight inches in thickness. Below this is a loose, powdery leached material, ashy grey to white in colour; varying in thickness and regularity of development.

The upper part of the subsoil is a deep yellow, reddish or orange-yellow in colour, soft and friable, although slightly packed. Below the depth of about 12 inches, this grades into a light brownish-red sandy loam with a pinkish cast. It is usually fine-textured, mellow and firm but breaks down easily into a loose, single grain condition. It is porous and permits free penetration of roots. Below 32 inches the subsoil grades into a light brown or light reddish-brown substratum, frequently banded with thin lenses of redder and finer sand, occasionally with fine gravel or pebbles.

While Canning soils are not entirely free from an indurated or hardpan formation, this does not appear to be so general as in the Nictaux series or Cornwallis soils. When present it is generally associated with coarser texture and is not so strongly cemented as in the Nictaux soils. Another characteristic of these soils is the presence of micaceous material in the lower subsoil and substratum.

Canning soils have been mapped as sandy loam and sand types. The sandy loam is the more important agriculturally and slightly more extensive. It occupies the smooth or more undulating topography and has a slightly higher content of the finer soil particles throughout the solum than has the sandy type. This gives the sandy loam an advantage in respect of moisture-holding capacity, consequently a slightly higher agricultural value.

The chief areas of Canning sandy loam are south of Melvern Square and north of Canning. Canning sand is found on the more rolling areas north of Melvern Square, east of Centreville, and south of Lakeville, where it penetrates a large area of Cornwallis soils from which it is sometimes difficult to make a separation. The coarser texture of the solum permits quite rapid drainage and rapid drying out; the tendency to an indurated condition of the B horizon is more frequent in the sand than in the sandy loam type.

A profile description of a virgin sandy loam profile consists of:

A	0″– 1″	Pine and spruce needles.
	1″– 4″	Black partially decomposed organic matter.
	4″– 8″	Ashy grey or white fine sandy loam, loose and powdery.
B	8″–18″	Bright yellow sandy loam, loose and mellow.
	18″–38″	Light reddish-brown, deep pinkish cast; sandy loam; firm but friable. Particles of mica present.
C	below 38″	Light brown fine sand, weakly banded with lenses of darker red, fine sand containing a considerable amount of fine particles of muscovite mica. Has a decided pinkish cast when dry.

The sandy, porous character of the soil allows rapid percolation of rainfall and the extremely low total silt and clay, 19 per cent in the surface soil and 2 per cent in the parent material, emphasize the low moisture-holding capacity and the need for a good supply of organic matter. The organic matter, generally, tends to be low, although in places it will be as high as 12 per cent (C x 1.75) in the surface soil of a virgin profile. Conservation and building up

the organic matter will be one of the main problems of soil management in the Canning soils, if satisfactory productivity is to be obtained. Field observations and laboratory studies have shown that under prevailing cultural practice the organic matter is decreased considerably and needs renewing; this can be done by ploughing under barnyard manure, or green manuring crops or by mulching with weed and grass cuttings, muck or peat. The first two sources of material are to be preferred because they decompose more rapidly than the other materials, consequently provide more nitrogen, which as total nitrogen data show is only fair.

Canning soils are strongly acid throughout the profile, pH values are 5·0 or lower. Total and available phosphoric acid, also exchangeable potash are fairly high in the surface soils, but much lower in the subsoils, indicating the need of lime and the importance of organic matter in these soils in conserving soil fertility. This is borne out by observations made in the field, namely, that apple trees as well as field crops planted on Canning soils will respond to the use of lime and the regular ploughing under of organic matter.

Due to their porous nature Canning soils are not grassland soils; hay and pasture stands are very often thin on the ground and yields as a rule are low, and these crops often suffer from lack of adequate moisture supply. Because of easy penetrability of the subsoils, Canning soils are adapted to deep rooted crops, such as fruit trees. Some excellent orchards have been developed on the sandy loam type and where heavy applications of fertilizers are used and good cultural methods followed reasonably good yields are obtained. In the Melvern Square district strawberries are being grown fairly successfully where organic matter is liberally supplied. Moderately good stands of clover are obtained when lime is applied along with fertilizers and a short rotation system is followed. The natural vegetation consists of pine and spruce principally, with sweet fern and poverty grass as the chief ground cover.

AVONPORT SERIES

(2,285 acres or 0·9 per cent of total area)

Throughout the region are a few isolated and scattered areas of light-textured soils derived from post-glacial water-laid deposits over an estuarine clay. These soils are similar to the Nictaux and Cornwallis series but for the underlying clay which is reached at three to five feet from the surface.

Avonport soils occur as marginal terrace soils along the Annapolis and Avon Rivers in the vicinity of Avonport, Middleton, Bridgetown, Belleisle and Granville Centre. The topography is level to undulating and the drainage, generally, is adequate. Occasionally a slight mottling or a dull lustre is noticed in the lower subsoil due to moisture being held by the tight clay strata. Occasional stones or boulders are found on the surface; these are usually granite or trappean in origin.

The surface soil is greyish-brown to brown in colour, loose and fairly mellow. This is underlain by a whitish or light grey subsurface layer, irregularly developed. Below this the subsoil is yellowish-brown to reddish-brown in colour with a rusty brown staining sometimes noticed. Occasionally it is quite firm to compact or indurated, forming concretions or small pockets of ortstein or hardpan. The underlying substratum is yellowish-brown to brown in colour, coarser in texture, having a fairly high proportion of mixed, smoothly rounded gravel and shows a weak stratification.

Only one type has been mapped, Avonport sandy loam. In the vicinity of Middleton and near Belleisle the soils appear to have a slightly higher clay

content than is general. The following profile description is representative of the type:

A	0″– 8″	Brown sand to sandy loam, loose, mellow. Light grey sand, irregular pockets.
B	8″–18″	Brownish-yellow sand, slightly indurated.
	18″–38″	Light reddish-brown sand to sandy loam, firm.
C	below 38″	Brown gravelly sand, slight stratification, underlain at 5 feet by a brownish silty clay.

While the close proximity of the clay strata to the surface should prove a beneficial factor in the maintenance of moisture supply in dry seasons, it will impede the rate of percolation and in seasons of heavy rainfall, may prove detrimental, especially in the shallower profile.

Like the Cornwallis, Nictaux and Canning series, Avonport sandy loam is a porous, open-textured soil, low in clay content (6 per cent), which considered in the light of a low organic-matter content (3·8 per cent), rates this type of soil as having a low moisture-holding capacity. Although the underlying clay till influences the groundwater level, maintaining it at a high level during the periods of rainfall and in wet seasons, the surplus water drains away quickly and the soil dries out rapidly.

Field observations indicated that Avonport sandy loam is not a strong soil. This is confirmed by the results of analysis which show the total nitrogen, also the total and available phosphoric acid, to be low, in fact the phosphoric acid content is one of the lowest of any soil in the Valley area. Although the exchangeable potash is fairly high in the surface soil, the subsoils, generally, are low in exchangeable calcium and potash.

Another important factor to be considered is soil reaction, which is strongly acid, as shown by pH 5·3 or less throughout the profile, and the exchangeable hydrogen. The productive capacity of this soil will depend in large measure upon the cultural practices followed. Even though the soil mass is porous, Avonport sandy loam has not the same tendency to aridity that is common to other soils of similar texture. This is influenced by the position of the underlying clay. However, maintenance of an adequate organic-matter content must be considered in soil management. Soil reaction shows the need for lime and low phosphoric acid suggests emphasis on the phosphatic content of fertilizers applied.

A considerable proportion of the Avonport sandy loam is under general crops, mixed or timothy hay, and oats principally. Yields are similar to those obtained on the Nictaux and Cornwallis soils. Some orchards, particularly around Belleisle, have been planted on these soils. They are not so well developed nor so thrifty and profitable, neither have they proved so long lived as orchards on the heavier soils of the region. The productive capacity can be increased through good management. Because of more favourable moisture conditions, there is less tendency to aridity; Avonport sandy loam is better suited to grass than are the other light-textured soils mentioned above. This was to be seen in the thicker stands and better quality herbage of the grasslands, also in the heavier cut of hay.

MILLAR SERIES

(9,127 acres or 3·7 per cent of total area)

Throughout the region are areas of low lying, poorly drained soils, which have been mapped as the Millar series. The soils comprising this series occupy depressions, draws, and flat areas that serve as drainage basins for larger areas of better drained soils; they are also found along shallow stream courses.

Millar soils are variable, being light to medium in texture, reflecting the influence of the better drained soils with which they are associated. The poor drainage is caused by seepage and the accumulation of run-off water from the surrounding higher levels, and by a more or less permanently high water-table. Quite frequently the surface soils are water soaked, particularly after rains.

These soils are composed of a mixture of materials; sands, sandy loams, gravel and some silt and clay. They are mainly alluvial soils, probably post-glacial deposits from the associated soils. Some of the underlying materials are compact, the particles being held together to form a coherent mass, but when disturbed invariably disintegrate readily. The main areas are north of Berwick and Aylesford, southeast of Aylesford and south of Wilmot; numerous smaller areas are scattered throughout the sandy and gravelly soils of the Valley.

The surface layer is usually 6 to 8 inches thick, but in places ranges above 12 inches. It varies in colour from a dark brown, dark grey-brown to dark grey or black, depending upon the amount of organic matter present. Regardless of texture these soils have darker surface layers than the surrounding soils. In some cases the surface layer approaches a shallow muck. Below this the subsoil may be dull grey, yellowish-grey or greyish-yellow water soaked sand or a dull yellowish-brown to dull reddish-brown coarse sand to gravelly sandy loam, which may or may not be compacted. Mottling is present in varying degrees. At a depth ranging from 24 to 40 inches are brownish, brownish-grey, dull reddish-brown and dull reddish sands, sandy loam and gravelly sandy loam. Occasionally sufficient fine clay particles have been washed in to give the substratum a sandy clay character.

The poorly drained condition makes the Millar soils of low agricultural value. They are used principally for mowing and pasture. Where the water-table is not too close to the surface they are sometimes planted to oats. Because of their topographical position, artificial drainage would be difficult and with the large areas of better drained land, it is doubtful whether such a project would be profitable. Millar soils definitely are not suited to orchards.

GASPEREAU SERIES

(1,126 acres or 0·4 per cent of total area)

Gaspereau soils are medium-textured gravelly soils derived from igneous and metamorphic rock material, mainly of southern upland origin, which has been deposited by post-glacial waters. They are confined to the Gaspereau Valley. The topography generally is undulating to gently rolling, with a more level area bordering the Gaspereau River. While this level area has a shallow depth of soil and in some respects resembles a bottom land soil, it differs from the same in having some profile development which resembles that of the main area. Angular fragments and rounded cobbles are abundant over the surface and through the soil, giving it a decidedly gravelly to stony character. The gravel and stone content keeps the soil open and porous and the surface relief facilitates surface drainage so that the general drainage of Gaspereau soils is well established. On the level area along the river there are times when a fairly high water-table occurs.

The surface soil is brown to dark brown in colour. It is friable and frequently has a granular-like structure. The subsoils are brownish in colour, having more of a greyish to yellow cast in the upper subsoil and being redder with depth; it is somewhat lighter in texture than the surface soil. This is underlain by a coarse gravelly to cobbly substratum, dull reddish in colour and only slightly assorted. All of the soils of this group have been mapped as sandy loam. The porous nature of the profile allows for good root penetration, while the gravelly surface soil prevents too rapid surface run-off. In the more

level area the subsoil is firmer than is general with this type and root penetration is not quite so free. The profile description is as follows:—

A 0″— 6″ Brown sandy loam, gravelly to stony.

B 6″—10″ Yellow-brown sandy loam, containing considerable angular and rounded gravel and stones.

10″—30″ Browner, with dull reddish cast, stony, sandy loam.

C below 30″ Coarse gravel, cobbles and angular rock fragments, dull brownish-red in colour.

Because of the high proportion of coarse gravel or stone and low clay content in the subsoil and the parent material the Gaspereau sandy loam is a very porous soil, having a low capacity to hold moisture or plant nutrients. The organic-matter content also is low, this however is a factor the farmer can in large measure control. The low elevation and proximity to the Gaspereau River offers the possibility that deep rooted crops like fruit trees will reach a water-table or zone of moisture supply. This in part reduces the tendency to droughtiness in these soils although some orchards do suffer from lack of moisture in the dry part of the season and in dry years moisture supply will be a limiting factor in crop production.

Gaspereau sandy loam is strongly acid in reaction (pH 4·7) throughout the profile, and the lime requirement is fairly high in the surface and subsoil. Such a condition does not favour bacterial activity in the soil, which may partly explain why the decomposition of the organic matter and the release of nitrogen is slow, as indicated by the wide carbon-nitrogen ratio, 24·8 or more, although total nitrogen in the surface soil is fairly staisfactory. Total and available phosphoric acid are very low throughout the profile, exchangeable potash is high in the surface soil, but low in the subsoil.

Numerous rapid soil tests in orchards and increased crop yields have shown that, where lime is used and a well balanced manurial program followed, Gaspereau sandy loam will give a good response. Lime at the rate of 2 tons per acre, a well balanced nitrogenous fertilizer, especially in the absence of barnyard manure or leguminous green manuring crop and a good supply of organic matter are suggested as a basis upon which to build a sound soil management program.

Gaspereau sandy loam is practically all cleared and under cultivation. It is principally planted to orchards although some field crops are grown. The orchards, under good management, are fairly productive. Due to the porous nature of the soil, mulch should be used around the apple trees. This can be provided either by the use of barnyard manure or some green manuring crop such as buckwheat or by the use of marsh hay. While apples are the principal crop in this locality, plums are also grown in appreciable quantities. Some general farming, associated with cream production is carried on with such field crops as oats, barley and timothy or mixed timothy and clover hay being grown with varying success. But most of the feed for the dairy cattle is produced on the dykelands of the Gaspereau and Avon estuaries or Grand Pre dykeland area. Where hay and grain are grown on Gaspereau sandy loam good results are obtained when barnyard manure is applied in liberal quantities; and where this is supplemented by commercial fertilizers and lime, yields of around 72 bushels of oats and 2 tons of hay, per acre, have been obtained, but the general average is nearer 35 bushels of oats and 1 to 1½ tons of hay per acre.

NICTAUX SERIES

(18,321 acres of 12·1 per cent of total area)

Nictaux soils comprise one of the most important soil series in the Annapolis Valley by virtue of being the second largest in extent, also because of their physical characteristics and climatic factor. They comprise one of the lighter

textured groups of soils, developed as they are from unconsolidated material, mainly derived from granite, gneiss and other non-calcareous and metamorphic rocks, deposited by post-glacial waters.

The main area is located in Annapolis County, extending on both sides of the Annapolis River from Middleton to Bridgetown. There are a number of smaller areas in Kings County, south of Aylesford, Waterville, Cambridge and east of Kentville. The topography is generally level to undulating with occasional small areas more gently rolling. Owing to the open nature of the substratum, drainage is rapid, in some places it may prove excessive, causing the soil to be droughty.

Nictaux soils are usually free from stones or large boulders, but gravel occurs in varying quantities in the surface soil and is common in the lower subsoil and substratum. The surface layer consists of a greyish-brown to dark grey or black, fairly coarse-textured mineral layer ranging in thickness from 4 to 12 inches. This layer, in some cases, may be absent. In such places a layer of plant debris, usually coniferous needles, is frequently found. This organic layer is seldom more than 2 inches thick. Immediately below the dark coloured surface layer a characteristic layer of white or ashy grey highly leached material usually occurs, varying in thickness and development. Sometimes it is found only as pockets, or it may range from 2 inches to 12 inches or more in thickness and may penetrate as long narrow tongues into the underlying subsoil.

The subsoil often is a little heavier than the surface soil. It is deep yellow, orange-yellow or reddish-brown in colour and frequently becomes indurated to form a hardpan (Plate 1). This hardpan or ortstein formation varies in thickness and distribution. It may occur as nodules, cobbles or as a distinct layer 8 to 20 inches thick. It is locally known as "floating hardpan" and where developed to any marked degree retards, and may restrict altogether, root development and movement of capillary moisture.

Below the subsoil, generally below 30 to 40 inches from the surface, the substratum is a grey to greyish-yellow, coarse sand and fine gravel, stratified and becoming coarser with depth. Being developed from a coarse parent material Nictaux soils are naturally of a loose, porous nature. While very similar to the Canning and Cornwallis series, these soils have a slightly coarser feel, suggesting a higher precentage of coarse sand grains and the hardpan or ortstein development of the B horizon, is more frequently found in this series than in the other light-textured soils. This compacted B layer often is quite dark in colour, probably due to the infiltration and precipitation of humus or iron compounds carried down in the leaching process. Two types, sand and sandy loam with gravelly phases of each have been mapped. Some small areas, particularly west of Middleton, that are not typical of this series have been included. While having the same general profile development they usually occur in level to depressed areas and the drainage is not quite so good. The sandy loam is the dominant type, of which a general profile description is as follows:

A	0″– 6″	Dark grey-brown, medium coarse sandy loam, loose and structureless.
	6″–10″	Light or ashy grey to white loamy sand, powdery and structureless.
B	10″–20″	Dull yellowish-red or rusty brown sand, indurated to hardpan formation. Very hard to penetrate, structureless, breaking into irregular lumps.
	20″–30″	Reddish-brown sand, firmed and structureless.
C	below 30″	Yellowish-grey coarse sand and gravel, stratified.

Both types are coarser in texture throughout than either the Cornwallis or Canning soils. Although the sandy loam has a slightly higher content of finer clay particles than the sand, the advantage in this respect is not very marked and is confined principally to the surface soil and upper part of the B horizon. The sandy loam is more extensively used for farming than is the sand, the latter being mainly under scrub bush growth. The main area mapped as the gravelly phase of the sandy loam type has a higher gravel content throughout the profile, which gives it a more open and porous constitution.

Nictaux soils, generally, are strongly acid throughout the profile (pH 4·6 to 5·2), with the sandy loam tending to be less acid than the sand, particularly in the surface soils. Occasionally the substratum may be only slightly acid, with a pH of 6·2 to 6·5. Under intensive orchard practice the pH has been raised to 5·4 or more in the surface, and with a less marked effect on the subsoil.

On the average the organic-matter content is very low, around 2·5 per cent while occasional virgin or near virgin profiles will have a fairly high percentage. As the clay content also is quite low, around 5 per cent in the surface soil and 3 or 4 per cent in the subsoil and substratum, the moisture-holding capacity is low. Therefore it is essential that a soil management program for Nictaux soils should be based upon increasing the organic matter. Total nitrogen is very low, even in orchard soils, indicating low natural fertility. While it is evident from the chemical data and from crop performances that liberal applications of nitrogen, phosphoric acid and potash, as well as lime, particularly for clover hay and cover crops, are essential, they will have to be carefully used, especially soluble nitrogen carriers so as to prevent excessive loss through leaching.

Soils of this series are not grassland soils as is quite evident from the thin and stunted appearance of the vegetation of the pasture areas. The natural vegetation has been pine; one or two small stands still exist south of Kingston. Uncultivated areas are now under a scrub growth of wire birch, red pine, aspen and such low growing shrubs as brake, crowberry, Hudsonia; also *Danthonia spicata* and various species of ground fungi.

On the area of the Nictaux soils under cultivation some mixed farming is carried on, but crops of hay and grain are comparatively light, oats yielding around 20 to 25 bushels per acre and hay about 1 ton per acre. Orchards are scattered and relatively small in extent and they are often marginal or submarginal in regards to yields and profits, yields ranging from 36 barrels per acre to 86 barrels per acre. The trees do not attain the same growth as do those on some of the heavier types, although individual trees may reach a fairly old age.

Nictaux soils, like those of the Cornwallis series, offer possibilities for the growing of early truck crops. Some very good fields of carrots and early potatoes have been observed. The productivitiy and economic value of the Nictaux soils will depend to a considerable extent upon the cultural practice and the system of farm management. Relatively heavy use of commercial fertilizers and lime, and constant attention to the maintenance of the humus content of the soil and moisture supply are essential. Another factor to be considered in connection with the farming of these soils is the frost hazard; owing to their position along the lower part of the Valley floor, they lie within the frost belt of the region.

PEREAU SERIES

(1,363 acres or 0·5 per cent of total area)

The soils mapped as the Pereau series are light-textured soils developed from gravelly outwash material, principally of sandstone and trap rock origin. They are found as small isolated areas, generally along the margin of stream courses

north of Canning, west of Aldershot, in the vicinity of Coldbrook and west of Granville Centre. Occurring on smoothly rounded ridges or hummocky topography and having a fairly coarse gravelly substratum, the Pereau soils have rapid drainage which may become excessive.

The surface soil is dark greyish-brown to dark brown in colour, with little or no structure; this is underlain by a white or ashy grey sub-surface layer. The upper subsoil is yellow to orange-yellow in colour, loose and porous, usually gravelly, while the lower subsoil is generally brown to reddish-brown in colour, with a higher gravel content than the upper layers. Occasionally this layer may be quite firm. The underlying substratum is a reddish-brown or reddish-grey stratified gravel, rounded and subangular in shape, and of mixed origin, with igneous material forming a large proportion of the mass.

Pereau sandy loam is the only type in this series. A representative profile description consists of:—

A 0″— 2″ Dark grey-brown gravelly sand to sandy loam.
2″— 6″ Ashy grey gravelly sand, loose and structureless.

B 6″—10″ Yellow to brownish-yellow gravelly sand, loose and porous.
10″—34″ Brown or greyish red gravelly sand. Firmer than B_1 but porous and structureless.

C Reddish stratified gravel and sand.

This is not an important soil in the agriculture of the Valley because of its limited extent and general leachiness. Due to the gravelly, porous nature of the soil and its relatively low clay content internal drainage is rapid, moisture-holding capacity low and the soil is likely to be droughty. About one-third of the land is cleared, the remainder being covered by young tree growth, consisting of spruce, birch, pine and poplar, with a ground cover, mainly sweet fern.

The cleared land is principally used for orchards, and while the trees are not so large or vigorous as on some other soils, fair yields can be obtained by careful management and liberal applications of fertilizers.

Pereau sandy loam is not suited to grass and general farm crops. Hay and grain crops often suffer from lack of moisture, stands are thin and yields low. Pasture herbage is thin and of poor quality, wild oat grass and poverty grass being the natural grasses. Careful management, with particular attention to the organic-matter content, and liberal applications of mixed commercial fertilizer will be necessary to obtain satisfactory yields on this soil type.

PROSPECT SERIES

(1,540 acres or 0·6 per cent of total area)

Prospect soils are fairly light in texture and are derived mainly from outwash material of granite origin. They occur along the southern boundary in isolated areas. The largest area is south of Waterville. Smaller areas are south of Bridgetown and Paradise; also near Tupperville, Round Hill, and Annapolis Royal. The topography is hummocky or smoothly rolling ridges, drainage is rapid, especially on the sandier knolls. Granite boulders and cobbles occur on the surface but have not prohibited the clearing of the land. Gravel persists throughout the soil mass, increasing with depth.

The surface soil is brown in colour, loose, moderately fine textured, and has a tendency to a granular structure. An irregular development of an ashy grey or leached subsurface layer frequently occurs. The subsoil is loose, porous and yellow to yellow-brown in colour, with very little differentiation except for

an occasional reddish or rusty cast. This is underlain by a grey gravelly substratum, composed mainly of granite gravel and generally stratified in the lower part.

Only one series has been mapped, Prospect sandy loam. Two small areas south of Berwick have a smoother relief and are slightly heavier. The heavier texture of the solum in these sections is probably due in part to the mixing of material from the heavier-textured Morristown soils of the vicinity. Owing to the gravelly parent material and low content of fine clay particles, Prospect sandy loam has a low moisture-holding capacity. A more favourable factor is the relatively high organic-matter content in the virgin soil, the cultivated fields and old grasslands however are low in organic matter. A representative profile description consists of:

A	0″- 8″	Light brown to brown gravelly, loamy sand, single grain to slightly pulverulent structure, loose and porous.
	8″-14″	Irregular pockets of ashy grey sand. Powdery, no definite structure, loose and porous.
B	14″-30″	Yellow to yellowish-brown gravelly sandy loam. The high proportion of gravel makes this horizon very open and porous with apparently no structure. Close examination shows that the finer soil particles sometimes coalesce to form crumblike granules.
C	below 30″	Grey gravel, composed principally of granite rock material. Distinct stratification.

The B horizon is occasionally found to have a thin B_1 development in the upper or first 2 inches. It consists of a rusty brown to black, coarse sandy lens, weakly cemented, and may show a tendency to have a thin plate-like structure. This type of development is caused, principally, by the accumulation of organic colloids deposited at this point in the profile, possibly because of a difference in pH levels. When desiccated it frequently becomes very hard and almost impervious, very similar to the hardpan formed through the accumulation of iron compounds.

These are extremely light open soils with over half of the soil mass composed of gravel and only about 3 per cent of combined silt and clay in the subsoil and substratum (B and C horizons). Due to the open and porous character of the profile, Prospect soils have very little body or retentive capacity for either moisture or plant nutrients, therefore, natural fertility is low and they are not very productive.

Soil reaction is strongly acid (pH 5·1) in the surface to medium acid (5·5 to 5·7) in the subsoil and parent material, with the lime requirement varying in proportion, namely, moderately high in the surface and quite low in the subsoil. Total phosphoric acid in the surface is fair but quite low in the subsoil, available phosphoric acid and exchangeable potash are low throughout the profile. The chemical results confirm field observations, that natural fertility of Prospect sandy loam is low.

Most of the area mapped as Prospect series has been cleared, but a large part is now reverting to scrub spruce, wire birch, and some pine or is rough pasture land. The herbage on these grasslands is of inferior quality and thin on the ground. In the dry season the fields look brown and practically bare at an earlier date than on the heavier soils. This is due to lack of adequate moisture supply. Some orchards have been planted but they are small in extent and the trees generally have a stunted, unthrifty appearance. Most of the cultivated land is used for general farm crops, such as oats, timothy hay and field roots, with varying results depending upon the amount of rainfall during the growing season.

An adequate supply of organic matter in Prospect soils is essential if they are to be cultivated. Due to the porous nature of the soil and the sparse herbage the building up of the organic-matter content may be a difficult problem. Barnyard manure and green manuring crops, such as buckwheat, rye and clover should be ploughed under regularly in a short rotational cropping system. Lime, at the rate of 1 to 1½ tons per acre, should be applied regularly in the rotation and commercial fertilizers, such as superphosphate or a 5-10-5 can be used to advantage.

The gravel substratum apparently provides good road-building material, gravel pits being found associated with this soil type.

TORBROOK SERIES

(8,963 acres or 3·7 per cent of total area)

These soils have formed from water-laid deposits composed of igneous and metamorphic rock material. They occur as interrupted belts along the lower slopes of the South Mountain. The topography is quite irregular, but as a rule it is rolling. Between Kentville and Wolfville the relief is more uniform and terrace-like in formation. The character of the relief combined with the numerous stream courses which traverse these soils and the gravelly nature of the subsoils assures adequate drainage. In seasons of comparatively low rainfall these soils are liable to be droughty.

Torbrook soils are found mainly in Kings County, extending intermittently from Torbrook Mines to Wolfville. A few sandier areas are mapped south of Lawrencetown, Paradise and near Hantsport. Stones and boulders occur on the surface. While not prohibiting the clearing of the land, their presence probably is responsible to some extent for the delay in agricultural development on this type. Gravel in varying amounts occurs throughout the profile.

The surface soil varies from greyish-brown to dark brown in colour. It invariably has a granular structure in the uncultivated soil, which is readily lost under cultivation. Smoothly rounded and flattened gravel of mixed origin occurs in this layer. It is underlain by an ashy grey to pale yellowish subsurface layer. Below this the subsoil is usually loose and porous in the upper part becoming firmer with depth. The colour ranges from deep yellow, yellowish-brown to reddish-brown, becoming browner in the lower section. The substratum is a brownish-grey gravel and sand, generally assorted and composed of rounded quartz, smooth flattish slate and igneous material.

The texture and structure of this soil is not uniform. Normally the lighter textured and lighter coloured soils occur on the knolls and steeper slopes. Occasionally pockets of clayey material occur in the substratum and the subsoil may be quite firm at times. Two types have been mapped, Torbrook sand and Torbrook sandy loam. The former is usually lighter in texture throughout, more open and porous. The sandy loam is the major type. A profile description follows:

A	0″- 6″	Dark brown sandy loam, quite loose and gravelly.
	6″-10″	Greyish coarser loamy sand to sandy loam. Loose and structureless. Contains fine gravel.
B	10″-18″	Bright brownish-yellow gravelly sandy loam.
	18″-36″	Brown with reddish cast, gravelly sand to sandy loam.
C	below 36″	Brownish-grey gravelly sand.

The analyses of this series confirm the field observations as to its generally low fertility. With 28 per cent gravel in the first six inches, 73 per cent in the

B horizon, with about 70 per cent sand throughout the first two feet and 95 per cent below this, water is apt to be a limiting factor and therefore available plant food kept at a low level on account of leaching.

While the total nitrogen is fair the high carbon-nitrogen ratio suggests that most of the nitrogen is unavailable, this is probably due to the soil acidity interfering with decay. Available potash and phosphoric acid are fair in the A layer. Root penetration should be good in such a soil. In general, the agricultural adaptations of the Torbrook soils will be similar to those of the Berwick series.

A considerable area of Torbrook soils is still under woods. Cleared land is principally in orchards. Because of the unsuitability of a considerable portion of the land to the use of modern farm machinery, general farming activities are not so prevalent on Torbrook soils as on the soils of the Middleton and Pelton series along the slope of the North Mountain. Oats and timothy with some white and red clover are the main field crops. When planted early and liberally fertilized, oat yields of 40 bushels per acre have been obtained.

FASH SERIES

(4,224 acres or 1·7 per cent of total area)

Fash soils are heavy textured and are derived from fine-grained, water-deposited material, probably an estuarine clay. The main area extends from Bridgetown to Belleisle along the north side of the Annapolis River. Other smaller areas are scattered throughout the section of the Valley located in Annapolis County, particularly the western section.

While these soils usually occur on nearly level to undulating topography, some areas are more smoothly rolling. Drainage is imperfect to fair; natural drainage courses and soil structure are such as to provide adequate facilities for surface drainage and moderately free movement of groundwater. The very fine texture of the subsoil, however, restricts the internal drainage, especially on the smoother topography. In wet seasons, poor drainage conditions may be set up temporarily. Boulders and rocks are not a serious problem, although some fine-grained trap rock and occasional granite boulders are found.

The profile is generally fairly free from gravel or stones, but in the area south of Brickton where the Fash soils mapped are in contact with Nictaux and Middleton series, there is a considerable quantity of gravel found.

The colour of the surface soil is usually a light shade of brown, greyish, yellowish and occasionally light reddish. When moist, the colour is frequently medium to dark brown or chocolate brown. In the uncultivated state the surface soil shows fair development of a crumb structure, (Fig. 10), which breaks down to form a mellow condition. Under cultivation this structure may be destroyed when the organic matter is depleted and the surface tends to bake and crack in very dry seasons. The surface soil is underlain by a friable subsurface layer, greyish-yellow to pale yellow-brown in colour.

The subsoil is usually a light brown to yellowish-brown, with a reddish cast, firm, and has a well developed nut-like structure, which becomes coarser with depth. This is underlain by a compact substratum deeper in colour than the subsoil and showing stratification or slight varying. When wet, this substratum becomes quite plastic and sticky, but when dry has a cheeselike consistency.

The compact nature of these soils has been in part responsible for retarding leaching; consequently Fash soils comprise one of the more fertile groups of soils in the region mapped. The structure of the solum should ensure good root penetration and movement of groundwater. Owing, however, to the consistency of the lower part of the profile and the smooth topography the internal drainage has been retarded as shown by the yellow mottling in the subsurface soil.

On the north side of the Annapolis River, these soils are adjacent to the Lawrencetown series and where they meet it is sometimes difficult to make a clear separation. A representative profile description consists of:

A	0″- 6″	Yellowish-brown clay loam, having a greyish cast when dry. Fairly good crumb-like structure, porous and mellow.
	6″-12″	Greyish yellow brown clay loam, more of a fine granular structure, mellow, slightly mottled.
B	12″-36″	Light chocolate brown clay, firm, having a nut-like structure which becomes cloddy with depth. Some yellow mottling and greyish cast to cleavage faces.
C	below 36″ or more.	Chocolate brown or light reddish stiff clay; cheesy consistency and plastic when wet.

This series has been separated in two types, namely, Fash loam—a few small areas of which have been mapped south of Lawrencetown and Brickton—and Fash clay, which is the predominating type.

Fash soils were classified in the field as being about the heaviest textured soils of the Valley as indicated by the consistency which points to a high content of silt and fine clay. This is confirmed by the mechanical analysis results (p. 87) which show the silt and fine clay content to be 32 and 33 per cent respectively in the A horizon with 24 or 26 per cent silt and 46 to 59 per cent fine clay in the subsoils. It is this factor rather than organic-matter content which is only fair (6%) that gives to these soils a high moisture-holding capacity. The 20 to 40 per cent of gravel is partly responsible for the satisfactory internal drainage and aeration that is found in what might otherwise be an impervious soil.

The parent material is well supplied with bases. Free carbonates, as shown by effervescence when treated with a weak solution of hydrochloric acid, are occasionally found below five feet and the reaction ranges from slightly acid to neutral. The surface soils are strongly acid, the pH being around 4·8 and the lime requirement very high—8 tons per acre—showing the need for lime. The chemical data further indicate the need for applications of nitrogenous and phosphatic fertilizers. The total phosphoric acid is low and with the available phosphoric acid and total nitrogen being only fair, the acidity of the surface soil is probably a major factor in the slow availability of these two plant nutrients. Either one or both of them are liable to be the limiting factor in crop growth, especially since potash levels, as shown by exchangeable potash data, are quite high. Practical orchard experience tends to confirm this, where only nitrogenous fertilizers were formerly used, complete mixtures have replaced them with satisfactory results.

A sound soil management program should aim at supplying the soil with lime, phosphoric acid, in such a form for instance as superphosphate, at about 400 lb. per acre, and organic matter, preferably as barnyard manure or a leguminous green manuring crop. Organic matter supplied in these forms will not only aid in maintaining a good surface tilth, but will also supply more nitrogen than some of the more fibrous crops and crop residues used for this purpose.

Considerable areas of the Fash soils are still covered by forest vegetation, mainly spruce, with some white birch. These soils are well adapted to general agriculture, and where cleared, support good crops of oats, barley and timothy hay. Good stands of clover are obtained when lime and manure are used with the nurse crop. While orchard plantings are limited in extent some very good blocks have been developed, but the trend has been more towards mixed farming than to specialized orcharding.

Organic Soils

MUCK AND PEAT

(5,416 acres or 2·2 per cent of total area)

Occupying some of the deeper depressions, sites of old ponds or shallow lakes, are deposits of organic soils derived from semi-decomposed and decomposing vegetable organic matter. These deposits vary in depth ranging from 2 feet to 10 feet or more. They are of two classes; peat and muck.

Peat (1,395 acres—0·6 per cent) is an accumulation of semi-decomposed organic matter in which the plant remains may still be recognized. It is usually browner in colour than muck, more or less fibrous or woody, and in the air-dried condition is light in weight. Two main areas of peat have been mapped. The largest known as the Caribou Bog is located west of Berwick on what was probably the site of an old shallow lake at the head of the Cornwallis River. A second area lies south of Aylesford.

The depth of the organic material ranges from 2 or 3 feet to 25 feet in the deepest part. The lake referred to kept filling with mineral wash from the uplands; various submerged fresh-water plants and waterlilies continued to grow outward from the lake margin and die, forming a layer of black well-decomposed peat which in time came near enough to the surface to allow Sphagnum moss to grow. The moss gradually formed moss peat to the depth of a foot or more; it continues to grow and build up a mass of vegetation from blueberry bushes and small trees elevated above the surrounding land forming the high-moor type of bog. Such an elevated bog cannot receive any mineral wash, especially lime, from the surrounding upland and gradually as the mosses decay becomes very sour.

The following table indicates the value of and variations in analysis in parts of one profile:—

TABLE 6.—CHEMICAL ANALYSIS OF SOME PEAT SAMPLES IN AIR DRIED MATERIAL

—	Water %	Org. Mat. %	Mineral %	Nit. %	pH	Lime Req.	Phos.	Potash
Layer 1	11·6	79·3	9·1	0·91	4·0	68·5	.....	.....
Layer 2—								
Upper 12 inches	10·4	70·2	19·4	1·01	4·0	53·1	.....	.....
Lower 24 inches	9·9	75·5	16·6	0·70	4·0	75·2	.....	.....
Layer 3	1·3	6·3	92·4	0·11	4·4	6·7	.....	.....
Surface of another part of deposit	4·1	64·1	30·8	0·54	.....	.....	0·03	0·07
Surface of another part of deposit	.....	92·3	4·45	1·12	.....	.....	0·2	.....

As usual such organic soils are very low in all mineral matter, such as, potash, phosphoric acid and lime. The soils are also very sour.

A profile description taken from a pit dug in the Caribou bog area consists of:—

8″ – 12″ Brownish fibrous mossy layer.

12″ – 48″ Dark brown to black spongy mass, with lenses of lighter coloured and more fibrous material. The lenses vary from 6 to 8 in. thickness.

48″ – 60″	Grey, medium coarse sand, porous and structureless.
60″ – 63″	Dark brownish-black to black coarse sand. Very compact and hard.
Below 63″	A greyish-yellow to yellowish-green fine sand, which grades into coarser sand and fine gravel.

The water-table at the time of examination was below 7 feet. The area south of Aylesford is very similar in general character, the organic layer averaging around 4 feet thick over the grey sand. The surface vegetation consists of a thick mat of rhodora, Laborador tea, sheep laurel, small cranberry as well as sphagnum and other mosses.

Muck (4,021 acres or 1·6 per cent) is the more thoroughly decomposed form of organic soil. Plant remains have lost their identity and a considerable portion of the organic matter has passed into the condition known as humus. When wet, muck is black or very dark brown and has an oozy consistency, but when very dry may be readily reduced to a black powdery state. Frequently muck will have a small admixture of mineral material that has been washed in from the surrounding mineral soils. Below the upper layer of well-decomposed material, which is variable in depth, 10 to 20 inches, the organic matter is not so highly decomposed, the material being more woody and fibrous. The underlying mineral material is similar to that described in the peat profile, in some places it is more of a fine silty sand or silt in texture. The depth of the organic material varies from 12 inches to 4 or 5 feet.

Two main areas of muck occur, one just west of and bordering the Caribou peat bog, and another south of Auburn. There are also numerous small areas of muck throughout the Valley. The main peat deposits are unimproved and have no immediate agricultural value. They have, however, a potential commercial value as sources of peat fuel and peat litter. A. Anrep[1] has estimated the Caribou bog alone to be capable of suplying approximately 5,815,000 cu. yds. of peat litter and 1,960,000 cu. yds. of peat fuel.

Some of the smaller areas of peat and a larger acreage of the muck soils, approximately 100 acres, are utilized for cranberry growing (Fig. 11). In normal years these cranberry areas have proved quite productive and profitable. It is, however, essential that there be a satisfactory water supply and adequate drainage facilities to allow for the flooding of the cranberry beds. This is necessary in order to provide protection against frost injury, since the major deposits of muck lie within the frost belt of the Valley.

Some of the smaller deposits of organic soils are utilized by the owners as a source of organic-matter supply for their upland soils, a practice which has proved highly beneficial. The well decomposed matter of layer No. 2 holds from 8 to 10 times its dry weight of water. When one part of peat is mixed with three parts of sandy soil of the Valley, the ability of the sandy soil to hold water is greatly increased; when peat is added to a heavy soil the tilth is improved. About 1 per cent nitrogen is the only plant food in Aylesford bog peat but it is very slowly available. Bog peat may be expected to exert its humus value much longer than manure or any green crop. The high acidity of this peat when added to supply humus demands an application of 5 to 10 pounds of basic material, as limestone, per cubic yard of moist peat. The well decayed Aylesford bog peat should be largely used in composting for vegetable growing and for mulching orchard trees.

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[1] A Anrep—Investigations of peat bogs and peat industry of Canada. Geol. Survey of Canada. Bulls. 8, 1910-11; 9, 1911-12, 11, 1913-14.

Miscellaneous Soils

DYKELAND

(14,035 acres or 5·8 per cent of total area)

In the estuaries of the Annapolis, Cornwallis, Canard, Gaspereau and Avon Rivers, also of the Habitant and Pereau creeks, are broad flats of marine soils that have been built up by tidal wave action. These flats have been protected from further tidal inundation by the building of dykes; hence the name "dykelands". The dykelands form one of the most interesting physiographic features of Nova Scotia. They are also of considerable agricultural importance. Dykelands, particularly those near Annapolis Royal and the famous Grand Predykelands (Fig. 12), have been under cultivation since the days of the earliest settlers.

The topography is nearly level or undulating, a striking feature about the general relief is that the elevation is usually lower along the inner boundary bordering the upland, than it is along the outside boundary. The soil profile varies within relatively short distances. Differentiation appears to be related in a large measure to mode of deposition and only feebly modified by weathering processes.

The surface soil consists of 6 to 10 inches of brown to chocolate brown or dark brown loam, silty clay loam or clay loam. In places there is evidence of a weak crumb-like structure, but cultivation has for the most part destroyed it. The surface is liable to bake and have shrinkage cracks when very dry. Below this may be a light grey to bluish-grey silty clay or clay, varying from 12 to 30 inches or more in thickness, with a variable amount of light yellow or rusty-brown mottling. In other places the subsoil is a light brown to chocolate brown in colour, and occasionally has some development of a nut-like structure.

Below a depth of 3 or 4 feet the soil is a silty clay or clay, more sticky and plastic and ranging in colour from grey, greyish-brown to bluish-grey or dark blue. Natural drainage is, on the whole, fairly good; but slight differences in elevation, variations in the level of the water-table due to daily tidal fluctuations and flooding by tidal water have caused some areas to be more poorly drained than others. These differences may be found within relatively short distances and the effects are to be observed in the depth of soil to the bluish-grey substratum. This is more evident in the dykelands of the Belleisle and Ronde-eau marshes where drainage conditions are not so good, generally, as in the case of the Grand Pre marsh. "Marsh Mud" has been eroded from the shores of the Bay and by rivers flowing into the Bay and its arms. It is brought into the Bay of Fundy by the tides twice daily, thoroughly mixed and returned and built up to form the marsh-lands of Minas Basin, Cobequid Bay, Cumberland Basin and the estuaries of such rivers as the Cornwallis and Avon, it is therefore quite reasonable that an analysis of any area of these marshes would be quite typical of other areas.

The composition of the dykelands is shown by analytical data (page 88) for a number of well-drained and poorly-drained dykeland soils taken from profiles in the Valley areas and in the Cumberland County marsh area. To offset variations that would be found due to individual treatments, average data have been taken. For further indication of the fertility of the surface soils of marshlands the complete analyses of two undyked, or salt marsh areas, one run-out dykeland soil, producing only $\frac{1}{2}$ ton of hay per acre, and one productive dykeland soil are given in table 7.

Analyses of marsh soils show that they are clays with about 50 per cent of silt and 34 per cent of clay. Sixty per cent of the poorly-drained soils, but only 5 per cent of the well-drained soils have high or very high chloride. Since these

TABLE 7.—COMPLETE ANALYSIS OF FOUR MARSH SOILS

(Solutions made using 1·115 sp.gr. Hcl)

Location	Insoluble Silica	Potash	Phosphoric Acid	Soda	Lime	Magnesia	Sulphuric Acid	Iron Oxide and Alumina	Moisture	Loss on Ignition	Nitrogen
	%	%	%	%	%	%	%	%	%	%	%
Falmouth— (Outside dyke)	84·9	0·58	0·13	0·48	1·05	1·4	0·14	7·3	0·27	4·22	0·05
Cornwallis River— (Outside dyke)	84·7	0·61	0·05	0·78	1·15	0·97	0·28	7·5	0·82	3·82	0·06
Amherst Point—Dyked— ($\frac{1}{2}$ ton hay per acre)	83·1	0·27	0·21	0·57	0·6	0·13	0·17	7·44	1·89	4·89	0·13
Experimental Farm, Kentville— (Dyked)	72·7	0·79	0·77	0·81	0·5	0·65	0·68	11·1	3·5	9·3	0·25

lands have been flooded by salt water more or less recently, medium chloride or salt might be expected in the soil, and since this material is poisonous to many plants, low fertility is natural to recently flooded marsh soils, and only drainage can be the remedy. Further, to correct acidity the well-drained soils require approximately 2 tons of ground limestone per acre, while the poorly-drained land requires about 3 tons per acre. Marsh soils have a good reserve of potential plant food and differ very little in total and available phosphorus, total nitrogen and available potash. As a rule they are quite fertile. The available phosphoric acid in the surface layers of the marsh soils is low (from 40 to 60 pounds of phosphoric acid per acre) compared with a very high content (from 350-450 pounds of phosphoric acid per acre) in the layers below a depth of 6 to 10 inches.

The results are particularly interesting in view of the fact that the surface layers are sour, whereas the lower layers are sweet. The sour surface layers apparently cause the phosphorus to be fixed in an unavailable form. The application of limestone will sweeten the surface soil and should aid in making large quantities of phosphoric acid available to the plant roots which feed in the surface layers. The available potash is high to very high in 95 per cent of the marsh surface soils. The magnesium and aluminum contents are high and the calcium content is very low in all the surface samples studied. Limestone contains calcium, so will improve this condition, and should also cause the soluble aluminum to be decreased. Aluminum is toxic to many plants and should be low for good growth.

The dykelands are productive soils, and are utilized for general farm crops. The principal crops grown are oats, timothy and clover hay, and field roots. Average yields of oats are around 50 to 60 bushels per acre, with yields of 110 bushels having been obtained by liberal applications of commercial fertilizer. Hay yields range from 2 to 4 tons per acre. The dykelands also provide very good grazing lands after the removal of the cultivated crops. The need for maintaining organic matter in the soil is emphasized, in order to bring about a desirable structure of the surface soil, and to protect it from excessive drying out and cracking.

Chemical tests and farm practice show that the two operations of importance in improving or maintaining proper soil fertility are, first, getting clear of salt by drainage of new marsh, second, use of limestone. The practice of short rotations should be included in the program of soil management as well as the use of commercial fertilizers.

SALT MARSH

(2,944 acres or 1·2 per cent of total area)

Associated with the dykelands are marine flats more recently built up outside the protecting dykes. These are known as "salt marsh". Salt marsh consists of tidal deposits of reddish or terra cotta coloured very fine sand, silty sand or silty clay which are being constantly reworked by the daily tides. As yet they are of minor agricultural importance, the only product being a certain amount of marsh hay that is cut during ebb tide. The salt marsh vegetation is usually marsh grass, glasswort, sea-blite and spurrey.

BOTTOM LAND

(9,787 acres or 4·0 per cent of total area)

Throughout the area surveyed are numerous stretches of alluvial soils deposited along stream courses and lying below flood level. These soils are variable in texture, ranging from gravelly material to fine sand, silt or clay. They are immature soils having little or no profile development and are periodi-

cally made over by new material deposited by flood waters. Any differentiation in the soil as seen in a vertical section is due to water action at the time of deposition rather than to weathering processes and the variations in the texture of the subsoil are as wide as those of the surface soil, although generally they consist of coarser material than do the surface soils. The depth of the soil also varies, ranging from a 10 or 12 inches to 3 feet or more. Because of their complexity and the fact that they comprise narrow stretches along the water-courses, and also because these areas are practically all used for hay or pasture, where cultivated, these deposits have all been classed together as Bottom Land. Occasionally, on the higher reaches, oats are grown and fairly good yields are obtained. Drainage is irregular, depending upon the seasonal fluctuations. In the spring or after heavy rains the drainage may be temporarily poor, but once the water-table is lowered the soil is moderately well drained.

Because of the frequent deposition of fine sediments and fertilizer residues from the higher land, bottom land soils are comparatively fertile. They are, however, of minor importance in the agriculture of the Valley area, comprising only a negligible acreage on individual farms.

ERODED LAND

(960 acres or 0·4 per cent of total area)

Throughout the region some narrow belts have been mapped as eroded soil. This does not refer to agricultural soils that have suffered damage by surface or sheet erosion. These are non-agricultural areas, principally steep-sided stream gullies, steep embankments and escarpments that are too steep and rough to permit being utilized other than for woods.

SOIL RATING

The adaptability of the soils to the various crops is summarized in table 8. In this table, the different soils have been rated as highly favourable, favourable, marginal, and unsuitable for six of the main crops grown in the Valley, namely; apples, oats, hay, turnips, potatoes, and pasture. This rating includes only the Valley soils, and is, therefore, only applicable to the soils in the surveyed area.

The most reliable measure of productivity and adaptability of a soil for any particular crop is obtained from the actual yields which have been produced. Unfortunately it has not been possible to date to obtain sufficient records of yields on the different soil types to permit a soil rating based on such data alone. The estimated rating in this table is based on soil characteristics, which are known from field observations and the interpretation of analytical data, on the habits and requirements of the different crops and supplemented by such yield records as are available. It is further based on the presumption that the prevailing management practices in the Valley, which usually include the use of some commercial fertilizer, have been used. It has been pointed out earlier, in the discussion of the individual soils, that the yield on any one soil series or type may vary tremendously in any one year, depending on the soil management practices followed, and on the amount and kind of fertilizer used. This would indicate that a soil which has been rated in this table as marginal for a certain crop, say hay, under average management, may, under improved practices, produce as much as a soil rated favourable or highly favourable. On the other hand, a soil rated as highly favourable for a certain crop may under poor management produce less than a soil rated as favourable or marginal.

The table shows that the different soils vary considerably in their rating for any particular crop. More than half of the soils have been rated as favourable or highly favourable for the production of any one or more of the following crops: apples, oats, hay, and turnips. A much smaller percentage is considered to be favourable or better for potatoes and pasture. The soils considered highly favourable for one crop are not necessarily so favourable for other crops. Thus, for instance, the soils, which have been considered to be unsuitable for apples, are rated as favourable or highly favourable for oats and hay (Millar sandy loam—exception). Some soils are suited for a variety of crops, while others are favourable for only one or two particular crops. This variation in the adaptability of the different soils shows clearly the difficulty of giving a soil one general rating for farming purposes, as such a soil may be entirely unsuitable for one or more crops and highly favourable for other crops.

TABLE 8.—SOIL RATING FOR PRINCIPAL CROPS

Symbols: HF = Highly Favourable; F = Favourable; M = Marginal; U = Unsuitable.

Soil Type	Apples	Oats	Hay	Turnips	Potatoes Commercial	Pasture
Annapolis sandy loam	F	F	F	F	M-U	M-F
Avonport sandy loam	M	M-F	M-F	M	U	M-F
Bridgetown sandy loam	F	F	F	F	U	M
Berwick sandy loam	HF	F	F	F	F	M
Canning sand	M	M	M-U	M	M	U
Canning sandy loam	F	M	M-U	M	F	U
Cornwallis sand	M	M-U	M-U	M	M	U
Cornwallis sandy loam	M	M	M-U	M	F	U
Falmouth sandy loam	HF	F	M	F	M	M
Falmouth loam	HF	HF	HF	F	U	F
Falmouth clay loam	F	HF	HF	F	U	F
Fash loam	F	HF	HF	F	U	F
Fash clay loam	F	HF	HF	F	U	F
Gaspereau sandy loam	HF	M-F	M	M	M	M
Hantsport loam	U-M	HF	HF	F	U	F
Hantsport clay loam	U-M	HF	HF	F	U	F
Kentville sandy loam	F	HF	F	F	F	M
Lawrencetown loam	U	F	HF	M-U	U	HF
Lawrencetown clay loam	U	F	HF	M-U	U	HF
Middleton loam	HF	HF	F	F	U	M
Middleton clay loam	HF	HF	F	F	U	F
Millar sandy loam	U	U	F	U	U	F
Morristown sandy loam	F	M	M	M-F	U	M
Morristown loam	HF	HF	F	F	U	M-F
Morristown clay loam	F	F	HF	F	U	F
Nictaux sand	M	M-U	M-U	U	M	U
Nictaux sandy loam	M	M	M	M-U	F	U
Pelton sandy loam	HF	F	M	F	HF	M
Pelton loam	HF	F	F	F	F	M
Pelton clay loam	HF	HF	F	F	M	M-F
Prospect sandy loam	M	M	M-U	M	M-F	U
Pereau sandy loam	M	M	M-U	M	M-F	U
Somerset sand	M	M	M-U	M	M	U
Somerset sandy loam	F	F	M	M-F	F	U
Torbrook sandy loam	F	M-F	M-F	M-F	M-F	M-F
Wolfville sandy loam	F	F	F	F	M-F	M
Wolfville loam	F	F	F	F	U	M
Woodville sandy loam	HF	HF	F	F	HF	M
Dykeland	U	HF	HF	F	U	HF

Note.—Estimation based on soil characteristics, and available yields under prevailing management.

The table clearly demonstrates the importance of growing the right crops on the right soils. Even in the Annapolis Valley, which is generally considered to be a good orchard area, only certain soils are favourable for apple production, while other soils are more suited for mixed or dairy farming. The type of farming which is to be practised successfully depends to a large extent on the nature of the soil.

SUMMARY

This is a report of the first systematic soil survey undertaken in Nova Scotia. The major purpose of it is to furnish basic information about the many soil types which may help the fruit grower and general farmer manage and improve the soil of his farm.

The area surveyed, designated the Annapolis Valley region, comprising approximately 386 square miles or 245,980 acres, lies in the northwestern section of the Province of Nova Scotia. General relief is undulating to gently rolling with the general direction of slopes north and south towards the Annapolis and Cornwallis Rivers.

The area lies in the podsol zone of the North American continent. The original vegetation was coniferous and mixed coniferous-hardwood forest. A surface mantle of glacial drift derived from igneous and sedimentary rock materials covers the area. The mineral soils through the main part of the Valley show the influence of the underlying Triassic rock formation. External drainage on account of differences in relief varies from satisfactory to excessive, the latter attended by serious erosion; internal drainage is good, except where glacial till forms a compact layer, or on low land. Twenty-three soil series and six miscellaneous soil groups have been mapped. The soil series have been further subdivided into soil types and phases giving 54 soil classes, having a wide variation in texture, ranging from relatively loose, porous sandy soils to compact clays.

In general, total phosphoric acid is low, especially in the subsoils. An average for the surface soil is ·1 per cent and for the subsoil ·03 per cent. Available phosphoric acid as a rule is low, 30 pounds per acre or less, to fair, 90 pounds. Phosphatic fertilizers applied to orchards cause 39 per cent of samples tested to show high phosphoric acid. High acidity tends to reduce the availability of phosphoric acid.

The total potash data at hand indicate that Valley soils in general are up to the average, about 1·6 per cent. Available potash, as shown either by the exchangeable bases or short tests is for most soils quite satisfactory; it ranges from ·1 to ·6 m.e. in the surface layer, but as high as ·99 m.e. in orchards where potassic fertilizers have been used. Short tests show that 90 per cent of surface samples of fertilized orchards and 46 per cent of the subsoils have high available potash.

Organic matter in the surface soil is fair, varying from 3 to 5 per cent; it is often higher in which case it consists of undecomposed material of low nitrogen content so that the soil has too high a carbon-nitrogen ratio, 19. The virgin soils have from ·1 per cent to ·25 per cent total nitrogen but tests show that available nitrogen ordinarily is low in the spring and fall.

The soils of the Valley are, in the main, strongly to medium acid pH 4·1 to 6·5 and for legumes, so important for supplying nitrogen and organic matter for exchange data show these soils to be relatively low in plant food, particularly calcium. Naturally the clay soils resist leaching so the exchangeable bases are higher than in lighter-textured soils.

Comparing the silica-sesquioxide data with similar data from podsols in the U.S.A. a close similarity is found. Study of the silica ratios, base exchange data, pH values and lime required show that more basic material is needed, especially in the A horizons of the Valley soils.

Since for a healthy root system the apple tree requires a soil pH from 5 to 6·5 and for legumes, so important for supplying nitrogen and organic matter for fruit trees and general crops, as well as for live-stock feed, a pH of 6 is advisable, therefore, an application of limestone at the rate of 2 tons per acre the first year, followed by one ton per acre every three years, is recommended.

Considering the relatively low organic-matter content, danger of erosion losses and the need for conservation of moisture, greater efforts should be made to increase and maintain the organic matter in the soil. This can be done by increased use of sod cultivation practice, ploughing down green manuring crops or applying mulch in such forms as green crops or peat hauled in from other land. Applications of commercial fertilizers, such as 2-12-6 or 5-10-5 mixtures, is suggested for most crops, at the rate of 500 lb. per acre, supplemented in orchards by two applications of nitrate of soda or sulphate of ammonia, totalling 250 lb. per acre. Before depending upon commercial fertilizers, barnyard manure should be used to get the most advantage from the standpoint of humus, plant food, and bacteria.

The information in the descriptions and explanations of analysis is necessarily general; it does not mean that every farm or field of any soil type will show the detailed characteristics as indicated in the report. Therefore in practice, every field should be studied and tested.

APPENDIX

Glossary of Soil Terms as used in Descriptions

Surface Soil.—The upper portion of a soil in which the mineral material and organic matter are mixed. Darker in colour than lower layers.

Subsurface Soil.—The horizon or layer of soil immediately beneath and intimately related to the surface layer. The A horizons below the A_1, the white or pale coloured leached layer or layers.

Subsoil.—The soil layer or layers underlying the above two layers, and extending down to a depth where a noticeable difference occurs. A layer or layers of material whose character has been influenced by soil forming processes.

Substratum.—The horizon or layers of material below the solum or true soil mass. The C horizons, in some soils it may refer to material quite distinct from that from which the overlying soil mass was formed (see also parent material).

Solum.—The weathered portion of the soil mass. The A and B horizons, or that part of the soil mass that has been changed or modified by soil forming processes.

Parent Material.—The unweathered or only slightly altered material beneath the soil mass. The material from which the soil profile develops, the C horizon. Should not be confused with the bed-rock from which parent material is produced through weathering processes.

Soil Profile.—A vertical column of the soil from the surface to the underlying unmodified material. It shows arrangement, thickness, colour, texture, structure, etc., of the different layers or horizons.

Horizon.—A layer or section of the soil profile, more or less well defined and occupying a position parallel to the soil surface.

Texture.—Refers to the relative size of the individual soil particles or grains, or the fineness or coarseness of the soil mass.

Structure.—A term expressing the arrangement of the individual grains and aggregates that make up the soil mass.

Soil Series.—A group of soils having the same profile characteristics, the same sequence of horizons, range in colour, structure, etc., and developed from a particular type of parent material. A group of soils similar in all respects except texture, particularly of the surface soil.

Soil Type.—Refers to a unit of soil differentiated on the basis of texture of the surface soil, principally. Other characteristics being similar to those of the other members of the soil series to which the type unit belongs.

Soil Phase.—A unit of separation of minor character within a soil type, such as differences in relief, stoniness or erosion. Differences which do not influence the soil to any marked degree; but have a significant practical or land-use value.

Mature Soil.—A soil in which the profile shows a full development of A and B horizons in equilibrium with the environmental factors.

Hardpan or Ortstein.—Hard, irregularly cemented material, usually found in the B horizons of the sandy profiles. It may exist as small round pebble-like formation, as large irregular lumps or in thick solid crusts or layers.

Till.—Unconsolidated mass of rock debris, boulders, gravel, sand or clay; the unsorted material left behind by glaciers and glacial action.

Methods of Analysis

The sample was prepared by air drying, passing through 2 mm. and 1 mm. sieves. The latter was used for analysis.

Hydrogen-ion concentration by method given in circular 56, United States Department of Agriculture, using the quinhydrone electrode.

Moisture, Loss on Ignition, Total Nitrogen and Phosphorus by methods according to A.O.A.C., Fourth-edition 1935.

Mechanical Analysis by Bouyoucos method in Soil Science Vol. 42—1936.

Silica, Iron and Aluminum in the Clay Fraction. The clay fraction was pipetted off and evaporated to dryness. The silica was determined after fusion with sodium carbonate. A.O.A.C. methods, page 5, 1935 edition.

Total Iron and Aluminum were determined in an aliquot after removing phosphorus and iron determined by the method in W. W. Scott's methods of chemical analysis, page 219, 1917 edition.

Lime Requirement by Jones method. Journal A.O.A.C. Vol. 1, page 43.

Readily available Phosphorus. Method by Truog, Journal American Society of Agronomy, Vol. 22, page 874.

Total Carbon: By reduction of chromic acid; method by Allison in Soil Science, Vol. 40, page 311.

Base Exchange: Determined by leaching with ammonium acetate and obtaining exchange capacity, total exchangeable bases, exchangeable calcium, magnesium and potash by methods developed in our laboratory in 1935 and appearing practically the same in the A.O.A.C. methods, Fifth-edition 1940.

TABLE 9.—SOIL CLASSES

Soils are composed of particles of different sizes as follows:

Soil Fraction	Size of Particles	Number of soil Particles per inch
1. Fine Gravel	2— 1 mm.	12— 25
2. Coarse Sand	1— .5 mm.	25— 50
3. Medium Sand	.5 — .25 mm.	50— 100
4. Fine Sand	.25— .1 mm.	100— 250
5. Very Fine Sand	.1 — .05 mm.	250— 500
6. Silt	.05 — .005 mm.	500— 5,000
7. Clay	Less than .005 mm.	More than 5,000
8. Fine Clay	Less than .002 mm.	More than 500,000

A few of the classes of soils referred to in this report are made up as follows:—

1. Sands contain less than 20 per cent of clay and silt, and 80 per cent or more of sand.
   (*a*) Coarse Sand—more than 25 per cent fine gravel and coarse sand, and less than 50 per cent of any other grade of sand.
   (*b*) Medium Sand (usually designated sand)—more than 25 per cent fine gravel, coarse and medium sand; and less than 50 per cent fine and very fine sand.

2. Sandy Loams contain 20-50 per cent clay and silt, with less than 20 per cent of clay (50-80 per cent sand).
   (*a*) Sandy Loam—more than 25 per cent gravel, coarse and medium sand.
   (*b*) Fine Sandy Loam—more than 50 per cent fine sand and less than 25 per cent gravel, coarse and medium sand.

3. Loams (other than sandy loams)—Soils containing more than 50 per cent clay and silt.
   (*a*) Loam—contains less than 20 per cent clay, less than 50 per cent silt, less than 50 per cent gravel and sand.
   (*b*) Clay Loam—20-30 per cent clay, less than 50 per cent silt.

TABLE X.—APPROXIMATE AREA OCCUPIED BY THE DIFFERENT SOIL TYPES; ALSO THE PERCENTAGE OF THE TOTAL AREA

Soil Type	Acres	Per cent	Soil Type	Acres	Per cent
Annapolis sandy loam	1,754	0·7	Morristown loam	5,590	2·3
Avonport sandy loam	2,285	0·9	Morristown clay loam	3,534	1·4
Berwick sandy loam	4,761	1·9	Nictaux sand	6,349	2·6
Berwick sandy loam, gravelly	4,524	1·8	Nictaux sand, gravelly	1,293	0·5
Berwick loam	1,069	0·4	Nictaux sandy loam	6,867	2·8
Bridgetown sandy loam	979	0·4	Nictaux sandy loam, gravelly	3,812	1·5
Canning sand	2,796	1·1	Pelton sandy loam	1,453	0·5
Canning sandy loam	3,136	1·3	Pelton loam	8,163	3·3
Cornwallis sand	24,646	10·0	Pelton clay loam	2,944	1·2
" sandy loam	4,079	1·6	Pereau sand	1,363	0·5
" " gravelly	1,043	0·4	Prospect sandy loam	1,540	0·6
Falmouth sandy loam	4,147	1·7	Somerset sand	2,617	1·0
Falmouth loam	2,771	1·1	Somerset sand, gravelly	742	0·3
Falmouth clay loam	684	0·3	Somerset sandy loam	6,522	2·6
Fash loam	825	0·3	Somerset sandy loam, gravelly	1,728	0·7
Fash clay loam	3,399	1·3	Torbrook sand	1,581	0·6
Gaspereau sandy loam	1,126	0·4	Torbrook sandy loam	7,382	3·0
Hantsport loam	1,850	0·7	Wolfville sandy loam	2,483	1·0
Hantsport clay loam	1,626	0·6	Wolfville loam	10,426	4·2
Kentville sandy loam	11,290	4·6	Woodville sandy loam	13,846	5·6
Kentville loam	2,581	1·0	Muck	4,021	1·6
Lawrencetown loam	1,888	0·8	Peat	1,395	0·6
Lawrencetown clay loam	11,191	4·5	Bottom land	9,787	4·0
Middleton loam	6,797	2·7	Dykeland	14,035	5·7
Middleton loam, rocky	550	0·2	Eroded	960	0·4
Middleton clay loam	9,555	3·9	Salt marsh	2,944	1·2
Middleton clay loam, rocky	1,184	0·5			
Millar sand	9,127	3·7	Total	245,981	
Morristown sandy loam	941	0·4			

(386 square miles)

TABLE 11—PHYSICAL AND CHEMICAL ANALYSIS OF REPRESENTATIVE SOIL PROFILES

Soil Type:	Middleton Loam (Uncultivated)				Middleton Loam (Orchard)				Middleton Clay Loam (Uncultivated)			
Horizon of Profile:	A	A_2	B	C	A	A_2	B	C	A	A_2	B	C*
Analysis of Whole Soil												
Depth in inches	0″–6″	6″–9″	9″–17″		0″–8″	8″–13″	13″–26″		0″–4″	4″–13″	13″–23″	
% Coarse and fine gravel	10	18	25	36	35	36	36	37	40	34	46	50
% Total sand (1) (1·0–0·05 mm)	.....	48	36	40	43	57	39	33	29	40	20	22
% Silt(1) (0·05–0·005 mm)	.....	24	24	22	40	29	31	37	44	37	38	44
% Total clay(1) (0·005–0·00 mm)	.....	28	40	38	15	13	30	30	27	23	42	34
% Fine clay (0·002–0·00 mm)	.....	22	36	32	11	9	20	23	20	17	34	26
% Water	3·2	1·9	3·7	4·2	1·9	1·1	1·7	0·2	2	0·6	1·8	—
% Loss on ignition	8·9	4·8	3·7	3·3	7	2·2	3·2	2·0	11·2	2·7	8·4	—
pH	5·3	5·2	5·3	6·4	5·5	5·4	5·7	5·9	4·7	5·1	6·2	6·9
Lime requirement (tons $CaCO_3$ per acre)	4·6	3·5	3·5	1·0	3·5	2·1	2·3	1·3	3·9	1·7	1·4	1·0
Available P_2O_5 (lb. per acre)	38	33	22	26	81	45	32	29	32	5	23	23
% Total P_2O_5	0·09	0·06	0·05	0·07	0·03	0·07	0·06	0·1	0·11	0·04	0·06	—
% Total nitrogen	0·25	0·13	0·05	0·06	0·19	0·06	0·07	—	0·4	0·2	0·02	—
% Organic carbon	4·8	1·42	0·4	0·08	2·9	0·59	0·56	—	4·9	0·53	0·13	—
C/N Ratio	19·2	10·9	8	1·3	15·2	9·8	7·7	—	12·4	2·6	6·5	—
m.e. Exch. H	6·0	4·0	3·9	0·2	8·6	4·0	2·8	1·3	8	2·7	1·8	0·3
m.e. Exch. Ca	7·3	3·3	6·2	11·1	5·6	2·6	7·3	9·0	7·3	2·4	10·9	12·0
m.e. Exch. Mg	1·12	0·75	1·8	2·2	0·85	0·51	1·8	1·1	2·6	0·96	4·3	3·6
m.e. Exch. K	.....	0·23	0·29	1·2	0·32	0·17	0·23	0·46	0·68	0·12	0·26	0·32
% Base saturation	58·0	51·6	68·0	98·8	44·04	45·05	76·9	89·03	56·9	56·3	89·5	98·7
Clay Fraction only—												
% SiO_2	49·2	51·6	50·7	51·1	50·6	47·4	51·1	46·6	49·3	53·1	49·9	51·2
% Fe_2O_3	4·8	5·8	8·5	6·8	7·7	8·0	9·3	9·9	7·4	8·2	9·6	9·6
% Al_2O_3	21·7	22·9	23·0	23·4	16·9	20·9	21·3	19·4	19·9	20·1	21·9	20·4
SiO_2/Al_2O_3	3·8	3·8	3·8	3·7	5·0	3·8	4·0	4·0	4·2	4·4	3·8	4·2
SiO_2/R_2O_3	3·4	3·3	3·0	3·1	3·9	3·1	3·1	3·0	3·4	3·5	3·1	3·3
% Loss on ignition	16·9	11·5	9·5	8·7	14·9	18·9	9·1	10·0	15·8	10·1	10·5	9·2

(1) Calculated on basis of 100%.

TABLE 11—PHYSICAL AND CHEMICAL ANALYSIS OF REPRESENTATIVE SOIL PROFILES—*Continued*

Soil Type:	Middleton Clay Loam (Orchard)				Pelton Clay Loam (Uncultivated)					Pelton Clay Loam (Orchard)		
Horizon of Profile:	A	A_2	B	C	A	A_2	B_1	B_2	C	A	B	C
Analysis of Whole Soil												
Depth in inches	0″–4″	4″–8″	8″–25″		0″–6″	6″–12″	12″–20″	20″–30″		0″–5″	5″–23″	
% Coarse and fine gravel	46	49	51	48	0	2	0	0	4	9	14	15
% Total sand(1) (1·0–0·05 mm)	31	33	29	35	34	34	54	36	38	36	35	55
% Silt(1) (0·05–0·005 mm)	40	39	27	35	45	41	24	42	40	34	42	30
% Total clay(1) (0·005–0·00 mm)	29	26	41	30	21	25	22	22	22	28	22	18
% Fine clay (0·002–0·00 mm)	21	22	35	24	16	18	17	18	17	22	18	15
% Water	1·2	0·6	1·0	—	1·5	0·7	—	—	—	2·1	2·1	1·0
% Loss on ignition	8·1	2·8	3·9	—	14·6	7·8	—	—	—	7·0	4·6	2·5
pH	6·0	5·9	5·6	6·3	5·0	5·2	5·0	4·9	4·9	4·9	4·8	4·6
Lime requirement (tons $CaCO_3$ per acre)	1·7	3·1	2·2	1·0	4·2	3·9	3·9	3·9	4·2	5·0	6·2	6·4
Available P_2O_5 (lb. per acre)	63	25	32	53	87	23	9	14	14	69	25	43
% Total P_2O_5	0·15	0·06	0·09	0·09	—	—	—	—	—	0·19	0·08	0·07
% Total nitrogen	0·21	0·09	0·08	—	0·28	0·17	0·06	—	—	0·16	0·08	0·04
% Organic carbon	2·8	1·05	0·16	—	5·22	2·43	0·62	—	—	1·9	0·81	—
C/N Ratio	13·4	11·6	2·0	—	18·6	14·2	10·3	—	—	11·9	10·1	—
m.e. Exch. H	7·1	5·9	1·9	1·8	8·1	7·2	7·2	7·8	6·5	7·8	9·5	6·5
m.e. Exch. Ca	8·3	3·9	9·2	10·1	8·0	5·3	1·6	1·3	0·9	4·9	1·7	1·5
m.e. Exch. Mg	1·31	1·28	2·14	3·3	0·09	0·07	0·22	0·3	0·1	0·40	0·14	0·33
m.e. Exch. K	0·51	0·23	0·35	0·47	0·57	0·57	0·21	0·49	—	0·53	0·38	—
% Base saturation	58·7	47·8	86·1	88·5	53·9	47·7	21·9	21·1	—	42·7	18·9	15·5
Clay Fraction only—												
% SiO_2	46·9	47·8	47·8	47·4	42·4	45·0	45·3	48·0	49·4	45·5	49·1	48·5
% Fe_2O_3	8·0	8·5	9·1	8·8	6·9	7·4	9·0	8·8	8·5	7·5	8·5	8·9
% Al_2O_3	19·7	19·6	21·7	18·7	19·1	21·3	20·7	23·7	24·7	21·6	21·2	19·6
SiO_2/Al_2O_3	4·1	4·2	3·7	4·3	3·7	3·6	3·7	3·4	3·4	3·6	4·0	4·2
SiO_2/R_2O_3	3·3	3·2	2·9	3·3	3·1	2·9	2·9	2·7	2·8	2·9	3·2	3·2
% Loss on ignition	16·1	13·7	15·5	11·9	23·0	18·5	14·8	11·7	11·0	—	—	—

(1) Calculated on basis of 100%.

TABLE 11—PHYSICAL AND CHEMICAL ANALYSIS OF REPRESENTATIVE SOIL PROFILES—*Continued*

Soil Type:	Kentville Sandy Loam (Virgin-2nd growth)					Kentville Sandy Loam (Orchard)				Falmouth Clay Loam (Uncultivated)				
Horizon of Profile:	A	A_2	B_1	B_2	C	A	B_1	B_2	C	A	A_2	B_1	B_2	C
Analysis of Whole Soil														
Depth in inches	0″-4″	4″-8″	8″-18″	18″-42″		0″- 10″	10″-18″	18″-37″	—	0″-6″	6″-12″	12″-20″	20″-39″	—
% Coarse and fine gravel	19	15	13	15	14	13	21	19	19	19	14	7	6	11
% Total sand(1) (1·0–0·05 mm)	63	63	50	54	53	82	70	64	56	44	56	48	30	40
% Silt(1) (0·05–0·005 mm)	27	27	27	22	28	3	15	14	16	34	18	18	26	28
% Total clay(1) (0·005–0·00 mm)	3	10	23	24	19	15	15	22	28	22	26	34	44	32
% Fine clay (0·002–0·00 mm)	1	7	14	16	15	13	11	16	22	16	20	34	36	28
% Water	1·5	0·8	3·0	2·0	1·7	3·1	1·2	1·6	2·8	4·9	0·7	0·7	1·2	1·4
% Loss on Ignition	4·8	1·9	5·1	4·1	2·4	6·4	3·2	3·2	2·6	12·4	5·0	3·6	3·5	3·2
pH	4·7	4·4	4·5	4·8	5·1	5·1	4·7	4·7	5·0	—	—	—	—	—
Lime requirement (tons $CaCO_3$ per acre)	5·6	3·9	7·4	7·9	2·1	3·1	4·6	4·6	1·7	8·4	4·6	4·6	2·8	1·4
Available P_2O_5 (lb. per acre)	36	32	40	28	50	170	64	41	37	32	23	23	23	23
% Total P_2O_5	0·08	0·07	0·06	0·03	0·05	0·2	0·08	0·02	0·07	—	—	0·04	0·08	—
% Total nitrogen	0·24	0·06	0·03	0·03	0·01	0·14	0·04	0·02	0·02	0·38	0·11	0·08	—	—
% Organic carbon	6·26	0·72	1·24	0·22	—	2·44	0·53	0·15	—	—	0·81	0·21	—	—
C/N Ratio	26·1	12·0	41·3	7·3	—	17·4	13·2	7·5	—	—	7·4	2·6	—	—
m.e. Exch. H	9·3	6·2	11·6	7·3	4·0	4·3	5·5	4·7	2·3	13·7	6·9	6·4	6	1·7
m.e. Exch. Ca	5·9	0·76	0·92	1·96	4·4	7·2	2·4	4·0	8·0	11·2	0·92	2·36	5·36	0·68
m.e. Exch. Mg	1·4	0·24	0·84	2·80	5·6	0·76	0·76	2·3	4·4	0·28	0·16	2·08	5·6	0·28
m.e. Exch. K	0·21	0·08	0·21	0·23	0·30	1·2	0·65	0·32	0·52	0·62	0·24	0·24	0·34	0·25
% Base saturation	44·6	14·8	14·6	40·6	72·0	68·0	40·9	58·4	84·8	46·9	16·05	51·2	65·3	41·5
Clay Fraction only:														
% SiO_2	48·1	58·7	48·8	53·4	56·2	38·0	45·9	50·5	49·0	43·2	51·0	44·9	48·2	49·2
% Fe_2O_3	3·8	4·6	4·8	8·2	7·0	7·2	5·9	5·9	5·3	6·0	6·4	9·6	9·2	8·4
% Al_2O_3	18·6	21·0	27·7	25·8	23·9	20·3	26·6	24·1	24·7	25·0	26·4	26·0	23·8	24·6
SiO_2/Al_2O_3	4·4	4·7	3·0	3·5	4·0	3·2	2·9	3·6	3·4	2·9	3·3	2·9	3·9	3·4
SiO_2/R_2O_3	3·9	4·2	2·7	2·9	3·4	2·6	2·6	3·0	3·0	2·5	2·8	2·4	2·8	2·8
% Loss on ignition	24·2	11·7	14·5	8·7	8·0	25·5	16·0	11·0	12·6	22·9	12·4	10·5	9·9	11·2

(1) Calculated on basis of 100%.

TABLE 11—PHYSICAL AND CHEMICAL ANALYSIS OF REPRESENTATIVE SOIL PROFILES—*Continued*

Soil Type:	Wolfville Loam (Uncultivated)				Wolfville Sandy Clay Loam (Orchard)				Wolfville Clay Loam (Uncultivated)		
Horizon of Profile:	A	A_2	B	C	A	A_2	B	C	A	B	C
Anaylsis of Whole Soil											
Depth in inches	0″-6″	6″-11″	11″-32″	—	0″-8″	8″-14″	14″-38″	—	0″-10″	10″-24″	—
% Coarse and fine gravel	20	19	20	13	18	29	34	40	10	19	22
% Total sand(1) (1·0–0·05 mm)	49	45	45	47	54	53	47	50	41	45	44
% Silt(1) (0·05–0·005 mm)	33	29	23	27	26	25	20	21	37	45	24
% Total clay(1) (0·005–0·00 mm)	28	26	32	26	20	22	33	29	22	10	33
% Fine clay (0·002–0·00 mm)	14	22	26	20	14	18	28	22	15	7	29
% Water	3·2	7·2	2·9	3·0	2·1	1·8	2·3	2·1	8·0	2·1	4·0
% Loss on Ignition	8·3	3·2	3·0	2·8	6·4	3·8	3·5	3·5	8·1	2·3	2·5
pH	4·7	4·5	4·9	5·7	5·3	4·8	4·8	5·2	5·5	5·6	5·3
Lime requirement (tons $CaCO_3$ per acre)	7·4	7·8	4·2	1·4	2·4	4·9	4·9	1·0	3·9	1·0	1·0
Available P_2O_5 (lb. per acre)	18	11	16	18	73	25	13	27	20·0	20·0	57·0
% Total P_2O_5	0·05	0·09	0·06	0·08	0·16	0·07	0·07	0·05	0·22	0·07	0·09
% Total nitrogen	0·2	0·03	0·05	0·02	0·11	0·05	0·03	0·03	0·25	0·03	0·02
% Organic carbon	3·29	0·75	0·17	0·14	2·52	0·67	0·23	0·24	1·85	0·14	0·06
C/N Ratio	16·4	25·0	3·4	0·7	22·8	13·4	7·6	8·0	7·4	4·6	3·0
m.e. Exch. H	10·4	9·0	6·4	2·5	3·9	7·6	6·2	1·4	5·8	1·2	0·7
m.e. Exch. Ca	2·1	1·8	3·9	10·0	5·5	0·68	6·1	2·8	6·0	3·2	9·8
m.e. Exch. Mg	0·88	0·88	3·0	5·3	0·18	0·44	3·5	0·75	0·14	1·4	5·9
m.e. Exch. K	0·34	0·17	0·22	0·17	0·91	0·39	0·42	0·22	0·13	0·12	0·25
% Base saturation	24·2	24·05	52·6	86·1	62·7	16·5	61·7	72·9	51·9	79·7	95·2
Clay Fraction only:											
% SiO_2	39·5	53·3	50·2	52·7	44·9	46·1	46·3	49·1	44·7	48·2	50·6
% Fe_2O_3	2·9	2·5	3·8	5·3	5·0	6·3	8·2	11·4	6·1	7·8	6·9
% Al_2O_3	22·6	27·7	30·5	25·2	24·0	27·4	26·8	24·1	22·7	25·8	24·9
SiO_2/Al_2O_3	2·9	3·3	2·8	3·8	3·2	2·9	2·9	3·4	3·3	3·1	3·6
SiO_2/R_2O_3	2·8	3·1	2·6	3·3	2·8	2·4	2·4	2·6	2·8	2·6	3·0
% Loss on ignition	19·4	10·4	9·1	8·1	19·3	14·0	12·0	11·5	18·9	10·8	8·9

(1) Calculated on basis of 100%.

TABLE 11—PHYSICAL AND CHEMICAL ANALYSIS OF REPRESENTATIVE SOIL PROFILES—*Continued*

Soil Type:	Hansport Loam (Virgin–2nd growth bush)					Lawrencetown Clay Loam (Uncultivated)				Somerset Sandy Loam (Uncultivated)			
Horizon of Profile:	A	A_2	B_1	B_2	C	A	A_2	B	C	A	B_1	B_2	C
Analysis of Whole Soil													
Depth in inches	0″–6″	6″–11″	11″–15″	15″–27″		0″–6″	6″–10″	10″–18″		0″–6″	6″–12″	12″–20″	Below 20
% Coarse and fine gravel	5	17	24	47	46	14	4	12	3	15	15	8	2
% Total sand(1) (1·0–0·05 mm)	41	43	45	36	38	26	31	21	23	72	70	76	76
% Silt(1) (0·05–0·005 mm)	42	42	34	28	24	42	42	40	42	18	22	20	18
% Total clay(1) (0·005–0·00 mm)	17	15	21	36	38	31	27	38	24	10	8	4	6
% Fine clay (0·002–0·00mm)	13	11	15	31	33	23	21	28	25	6	4	2	4
% Water	5·4	1·9	4·0	4·1	4·0	1·2	1·0	0·5	—	2·2	2·1	1·1	0·8
% Loss on ignition	11·4	2·6	5·0	3·5	3·2	6·7	3·1	3·5	—	5·1	3·6	1·8	1·4
pH	4·9	4·8	4·7	5·3	7·0	4·5	4·3	4·6	6·3	5·2	4·8	5·0	4·9
Lime requirement (tons $CaCO_3$ per acre)	7·4	2·8	2·4	3·5	1·0	7·8	5·6	5·4	1·1	2·4	2·8	1·7	3·5
Available P_2O_5 (lb. per acre)	25	23	30	12	137	28	46	18	18	23	14	23	23
% Total P_2O_5	0·05	0·07	0·06	0·07	0·1	—	0·02	0·04	—	0·1	0·03	0·02	0·02
% Total nitrogen	0·2	0·04	0·02	0·03	0·03	0·21	0·06	0·05	—	0·14	0·06	0·01	—
% Organic carbon	4·9	0·46	0·30	0·10	—	3·86	1·05	0·56	—	2·69	1·52	0·34	—
C/N Ratio	24·5	11·5	15·0	3·3	—	18·3	17·5	11·2	—	19·2	25·3	113·3	—
m.e. Exch. H	10·9	5·5	5·0	4·6	1·4	12·0	8·9	7·3	0·8	4·5	4·9	2·7	3·3
m.e. Exch. Ca	2·12	0·64	1·16	4·6	9·2	3·8	1·8	2·9	12·5	2·7	0·88	1·0	0·84
m.e. Exch. Mg	1·1	0·40	1·0	3·76	6·3	0·86	0·50	1·0	3·1	0·48	0·08	0·24	0·28
m.e. Exch. K	0·33	0·15	0·13	0·26	0·18	0·27	0·02	0·13	0·58	0·25	0·11	0·08	0·08
% Base saturation	24·5	17·7	31·4	65·2	91·8	29·1	20·6	35·5	95·2	43·2	17·9	32·5	26·6
Clay Fraction only—													
% SiO_2	48·8	50·8	51·6	53·4	55·1	53·8	52·7	53·0	51·4	43·2	45·0	—	66·7
% Fe_2O_3	3·6	4·0	3·7	3·4	3·7	1·9	2·9	9·8	9·0	7·9	9·8	—	6·4
% Al_2O_3	21·7	27·7	28·8	27·6	26·5	26·1	20·6	23·2	20·0	14·5	21·6	—	21·6
SiO_2/Al_2O_3	3·8	3·1	3·0	3·2	3·6	3·4	4·9	5·8	4·3	5·1	3·6	—	5·2
SiO_2/R_2O_3	3·5	2·8	2·8	3·0	3·3	3·3	4·5	3·0	3·3	3·7	2·7	—	4·4
% Loss on ignition	19·9	12·1	10·0	9·0	8·0	18·1	10·3	11·6	10·4	24·5	19·0	13·0	9·8

(1) Calculated on basis of 100%.

TABLE II—PHYSICAL AND CHEMICAL ANALYSIS OF REPRESENTATIVE SOIL PROFILES—*Continued*

Soil Type:	Woodville Sandy Loam (Uncultivated)					Woodville Sandy Loam (Orchard)					Bridgetown Sandy Loam (Uncultivated)			
Horizon of Profile:	A	A_2	B_1	B_2	C	A	A_2	B_1	B_2	C	A	B_1	B_2	C
Analysis of Whole Soil														
Depth in inches	0″–8″	8″–14″	14″–23″	23″–47″		0″–9″	9″–15″	15″–24″	24″–40″		0″–10″	10″–14″	14″–22″	Below 22″
% Coarse and fine gravel	6	12	10	9	10	15	15	19	24	19	13	12	11	39
% Total sand(1) (1·0–0·05 mm)	65	74	69	63	69	62	63	68	68	69	67	83	93	72
% Silt(1) (0·05–0·005 mm)	25	22	23	19	16	24	26	19	20	19	25	12	4	18
% Total clay(1) (0·005–0·00 mm)	10	4	8	18	15	13	10	13	12	12	7	5	4	9
% Fine clay (0·002–0·00 mm)	8	2	6	17	10	9	6	9	8	8	4	3	3	6
% Water	4·6	2·1	0·7	2·6	3·1	1·4	0·5	1·4	1·2	1·0	1·8	1·5	1·1	0·8
% Loss on ignition	2 95	3·4	1·4	3·0	2·0	5·6	1·5	3·5	3·0	1·7	4·6	2 3	2·1	2·0
pH	4·8	5·0	4·9	4·9	4·9	5·5	4·8	4·7	4·6	4·6	5·9	5·7	5·7	5·9
Lime requirement (tons $CaCO_3$ per acre)	4·9	1·4	1·7	1·7	5·3	3·5	2·9	4·5	4·3	4·8	2·1	1·6	1·2	0·8
Available P_2O_5 (lb. per acre)	56	26	40	112	72	71	24	20	25	36	18	13	13	46
% Total P_2O_5	0·12	0·03	0·07	0·06	0·05	0·1	0·02	0·01	0·02	0 02	0·07	0 03	0 03	0·07
% Total nitrogen	0·21	0·01	0·03	0·01	0·01	0·13	0·02	0·05	0·06	0·02	0·13	0·04	0 03	—
% Organic carbon	4·14	0·19	0·64	0·1	0·12	2·28	0·26	0·77	1·07	—	2·3	0·55	0 40	—
C/N Ratio	19·7	19·0	21·3	20·0	24·0	17·5	13·0	25·4	17·8	—	17·7	13·7	13·3	—
m.e. Exch. H	8·4	2·0	4·2	6·3	5·8	4·5	4·0	4·0	5·3	6·4	4·1	2 9	2·4	1·3
m.e. Exch. Ca	2·5	0·84	0·44	0·68	0·84	4·8	1·05	1·29	1·15	1·56	3 0	0·8	0·72	0·26
m.e. Exch. Mg	1·24	0·56	0·32	0·96	1·24	0·35	0·16	0·15	0·18	0·30	0 93	0·36	0·36	1·72
m.e. Exch. K	0·47	0·20	0·13	0·25	0·28	0·29	0·11	0·32	0·37	0·38	0·16	0·15	0·11	0·20
% Base saturation	33·3	44·4	17·4	23·0	29·0	57·7	24·8	30·6	24·3	25·9	50·1	31·1	33·1	62·6
Clay Fraction only—														
% SiO_2	43·9	61·5	46·5	50·5	50·4	44·5	54·1	48·4	47·8	48·7	52·2	36·9	35·5	47·3
% Fe_2O_3	5·6	4·4	7·2	9·6	6·8	8·1	7·3	7·9	8·9	8·2	3·7	8·2	8·2	5·6
% Al_2O_3	18·3	18·6	21·6	17·9	25·2	19·7	19·2	22·1	22·1	20·1	19·3	21·8	24·8	28·4
SiO_2/Al_2O_3	4·0	5·6	3·5	4·8	3·4	3·9	4·7	3·8	3·8	4·3	4·6	2·9	2·4	2·8
SiO_2/R_2O_3	3·4	4·9	2·9	3·6	2·9	3·0	3·8	3·1	3·0	3·4	4·1	2·3	2·0	2·5
%Loss on ignition	25·6	7·9	15·8	9·1	9·1	29·3	54·3	23·6	25·6	26·4	24·1	24·3	22·0	12·6

(1) Calculated on basis of 100%.

TABLE 11.—PHYSICAL AND CHEMICAL ANALYSIS OF REPRESENTATIVE SOIL-PROFILES—(*Continued*)

Soil Type:	Berwick Sandy Loam (Uncultivated)					Berwick Sandy Loam (Orchard)					Morristown Sandy Loam (Virgin—2nd growth)			
Horizon of Profile:	A	A_2	B_1	B_2	C	A	A_2	B_1	B_2	C	A	A_2	B	C
Analysis of Whole Soil														
Depth in inches	0″-4″	4″-10″	10″-18″	18″-32″	Below 32″	0″-8″	8″-15″	15″-25″	25″-42″	—	0″-6″	6″-10″	10″-26″	—
% Coarse and fine gravel	29	24	18	32	32	31	24	38	37	43	1	10	11	24
% Total sand(1))1·0-0·05 mm)	72	76	82	85	78	67	67	70	71	69	60	47	48	77
% Silt (1) (0·05-0·005 mm)	18	16	9	8	12	20	21	19	16	15	26	44	43	15
% Total clay (1) (0·005-0·00 mm)	10	8	9	7	10	12	10	11	13	15	14	9	9	8
% Fine clay (0·002-0·00 mm)	6	6	8	6	7	8	6	8	9	10	10	6	8	6
% Water	—	1·8	0·8	0·7	1·0	1·9	0·7	2·1	1·1	1·1	12·1	1·6	3·3	1·5
% Loss on ignition	4·3	3·2	1·1	1·1	1·4	5·9	2·6	3·3	1·8	2·0	12·3	2·8	3·3	1·9
pH	5·5	5·3	4·9	5·0	5·0	5·2	4·9	4·8	4·9	5·0	5·1	5·0	5·0	5·1
Lime requirement (tons $CaCO_3$ per acre)	2·1	2·4	1·7	1·7	—	4·5	3·2	2·9	3·2	2·9	5·6	2·4	2·4	1·7
Available P_2O_5 (lb. per acre)	26	19	13	18	19	79	33	28	28	36	20	19	19	0·16
% Total P_2O_5	0·11	—	0·04	—	0·02	0·19	0·03	0·06	0·04	0·06	0·1	0·07	0·08	0·07
% Total nitrogen	0·11	0·03	0·07	0·02	0·02	0·17	0·04	0·05	0·02	0·01	0·3	0·04	0·02	0·02
% Organic carbon	0·29	—	0·92	1·94	—	2·31	0·56	0·43	0·11	—	5·92	0·51	0·18	—
C/N Ratio	2·6	—	30·6	27·7	—	13·6	14·0	86·0	55·0	—	19·7	12·8	9·0	—
m.e. Exch. H	2·7	2·3	1·7	1·8	2·9	5·3	3·6	3·9	4·2	3·5	10·5	4·4	4·2	2·6
m.e. Exch. Ca	1·76	0·96	1·0	1·0	1·0	4·14	1·93	1·32	1·60	2·63	3·2	1·1	2·6	2·2
m.e. Exch. Mg	0·52	0·32	0·48	0·52	0·72	0·44	0·23	0·16	0·36	0·43	1·96	1·16	0·72	1·1
m.e. Exch. K	—	—	0·22	—	0·14	0·37	0·16	0·28	0·19	0·35	0·14	0·13	0·8	0·12
% Base saturation	—	—	50·0	—	39·07	48·3	39·2	31·0	33·8	49·3	33·1	36·2	45·4	56·8
Clay Fraction only:														
% SiO_2	41·5	—	44·5	—	49·0	43·5	51·9	43·8	50·5	50·9	45·9	50·7	50·1	51·2
% Fe_2O_3	6·3	—	6·0	—	6·5	8·0	7·0	8·6	7·5	7·5	4·6	5·8	6·4	7·2
% Al_2O_3	18·1	—	28·5	—	24·6	22·2	20·4	20·2	22·7	22·1	19·8	22·5	26·9	23·1
SiO_2/Al_2O_3	3·8	—	2·6	—	3·4	3·4	4·3	3·7	3·8	4·0	3·9	3·8	3·2	3·8
SiO_2/R_2O_3	3·1	—	2·4	—	2·9	2·8	3·6	3·0	3·0	3·3	3·4	3·3	2·7	3·2
% Loss on ignition	24·5	—	13·5	—	11·1	25·0	12·1	13·5	10·2	9·9	21·3	12·8	10·6	10·0

(1) Calculated on basis of 100%.

TABLE 11.—PHYSICAL AND CHEMICAL ANALYSIS OF REPRESENTATIVE SOIL PROFILES—(*Continued*)

Soil Type:	Morristown Loam (Orchard)				Morristown Clay Loam (Uncultivated)			Morristown Clay Loam (Orchard)		
Horizon of Profile:	A	A_2	B	C	A	B	C	A	B	C
Analysis of Whole Soil										
Depth in inches	0″-6″	6″-14″	14″-24″	—	0″-3″	3″-11″	—	0″-6″	6″-18″	—
% Coarse and fine gravel	45	50	72	84	60	57	68	40	38	38
% Total sand (1) (1·0–0·05 mm)	41	43	56	69	50	47	49	44	42	41
% Silt (1) (0·05–0·005 mm)	45	44	31	21	24	43	29	31	35	38
% Total clay(1) (0·005–0·00 mm)	14	13	13	9	26	10	22	25	23	21
% Fine clay (0·002–0·00 mm)	11	10	9	7	11	8	18	15	15	13
% Water	4·1	3·7	3·9	2·1	15·5	4·1	4·0	3·7	3·0	1·7
% Loss on ignition	12·1	7·6	9·3	5·9	12·4	7·4	5·6	10·0	6·5	4·1
pH	5·3	5·2	5·2	5·2	4·8	4·8	4·4	4·4	4·4	4·4
Lime requirement (tons $CaCO_3$ per acre)	4·2	3·5	3·7	2·4	6·0	3·5	6·0	7·4	4·9	4·2
Available P_2O_5 (lb. per acre)	110	37	68	55	65	41	13	220	35	105
% Total P_2O_5	0·23	0·11	0·14	0·12	0·24	0·19	0·13	0·51	0·12	0·14
% Total nitrogen	0·35	0·1	0·12	0·06	0·25	0·07	0·06	0·2	0·05	0·02
% Organic carbon	5·84	1·99	2·15	0·91	5·2	2·14	1·16	4·0	1·25	0·66
C/N Ratio	16·7	19·9	17·9	15·1	20·8	31·6	19·3	20	25	33
m.e. Exch. H	7·9	9·6	9·5	4·7	8·9	5·5	7·0	14·0	8·8	7·2
m.e. Exch. Ca	6·7	1·7	1·08	0·88	3·5	0·56	0·56	3·8	1·8	1·8
m.e. Exch. Mg	1·0	0·76	0·48	0·45	1·4	0·28	0·32	0·48	0·60	0·72
m.e. Exch. K	1·01	0·44	0·35	0·27	—	0·24	0·24	0·59	1·33	0·22
% Base saturation	52·4	23·2	16·7	24·4	—	16·4	—	25·8	29·8	27·5
Clay Fraction only:										
% SiO_2	22·8	35·3	30·5	30·8	37·9	38·5	45·4	42·4	46·5	53·2
% Fe_2O_3	8·0	11·2	10·3	10·1	7·6	9·6	7·3	8·4	8·4	7·6
% Al_2O_3	19·0	22·3	20·7	22·4	21·9	25·9	26·2	25·0	23·0	26·2
SiO_2/Al_2O_3	2·6	2·7	2·5	2·3	2·9	2·5	2·9	2·8	3·4	3·4
SiO_2/R_2O_3	2·0	2·0	1·9	1·8	2·4	2·0	2·5	2·4	2·8	2·9
% Loss on ignition	38·0	26·8	31·0	31·0	26·0	21·2	14·1	21·2	14·5	8·9

(1) Calculated on basis of 100%.

TABLE 11—PHYSICAL AND CHEMICAL ANALYSIS OF REPRESENTATIVE SOIL PROFILES—*Continued*

Soil Type:	Annapolis Sandy Loam (Uncultivated)				Cornwallis Sand (Virgin Profile)					Cornwallis Sandy Loam (Virgin Profile)				
Horizon of Profile:	A	B_1	B_2	C	A	A_2	B_1	B_2	C	A	A_2	B_1	B_2	C
Analysis of Whole Soil														
Depth in inches	0″–12″	12″–30″	30″–48″		0″–3″	3″–8″	8″18″	18″–36″		0″–4″	4″–8″	8″–16″	16″–24″	
% Coarse and fine gravel	7	14	1	47	4	10	13	11	5	6	3	4	1	1
% Total sand(1) (1·0–0·05 mm)	68	58	31	70	95	82	87	98	92	72	70	68	55	82
% Silt(1) (0·05–0·005 mm)	25	29	39	21	3	14	8	1	4	22	25	18	32	15
% Total clay(1) (0·005–0·00 mm)	7	13	30	9	2	4	5	1	4	6	5	14	13	3
% Fine clay (0·002–0·00 mm)	5	12	27	7	0	2	2	0	3	4	4	8	10	2
% Water	1·4	3·6	3·5	1·5	0·2	—	—	—	—	0·6	0·2	2·2	1·5	0·8
% Loss on ignition	5·3	6·6	3·9	2·3	4·1	0·2	—	—	—	3	0·6	4	2·8	1·8
pH	5·1	5	5·1	5·2	—	4·3	5·1	4·9	4·9	4·3	4·4	4·6	4·4	4·4
Lime requirement (tons $CaCO_3$ per acre)	2·9	3·9	3·1	9·2	4·7	1·4	1·7	1·4	1·4	2·8	1·7	1·7	2·1	2·8
Available P_2O_5 (lb. per acre)	13	13	23	18	37	32	60	38	38	13	10	8	27	35
% Total P_2O_5	0·08	0·1	0·07	0·09	—	—	—	—	—	—	0·01	0·04	0·03	0·08
% Total nitrogen	0·15	0·09	0·02	0·02	0·13	0·02	0·02	—	—	0·03	0·01	—	0·01	—
% Organic carbon	2·1	0·15	0·11	—	—	0·169	0·310	—	—	2·63	0·16	0·49	—	—
C/N Ratio	14	1·7	5·5	—	—	8·4	15·5	—	—	87·6	53·3	—	—	—
m.e. Exch. H	4·6	6·5	5·7	1·9	7·1	1·0	4·1	2·3	1·6	4·3	2·5	3·1	7·3	3·3
m.e. Exch. Ca	1·64	0·8	3·44	0·64	1·9	0·6	0·5	0·5	0·4	0·48	0·52	0·52	0·52	0·56
m.e. Exch. Mg	0·76	0·48	4·12	0·42	0·4	0·2	0·2	0·2	0·16	0·18	0·06	0·34	0·06	0·03
m.e. Exch. K	0·33	0·17	1·77	0·12	0·24	0·02	0·01	0·01	0·04	0·09	0·04	0·07	0·11	0·09
% Base saturation	37·2	18·2	62·7	35·2	26·3	45·1	14·7	23·5	27·2	14·8	20·3	23·2	6·2	17·1
Clay Fraction only—														
% SiO_2	41·5	38·3	47·7	46·0	41·1	58·2	38·3	35·8	48·5	43·8	60·5	41·6	37·4	48·5
% Fe_2O_3	7·4	5·6	5·8	4·5	5·5	3·2	8·0	7·0	8·7	7·9	4·2	7·7	5·4	6·3
% Al_2O_3	18·6	26·9	27·2	27·0	13·0	13·0	5·0	28·0	23·3	25·9	22·2	16·3	20·4	25·3
SiO_2/Al_2O_3	3·8	2·4	3	2·9	6·3	8·8	12·8	7·7	3·5	2·9	4·5	4·3	3·3	3·3
SiO_2/R_2O_3	3	2·1	2·6	2·6	4·9	7·5	6·4	1·9	2·9	2·4	4·1	3·3	2·7	2·8
% Loss on ignition	26·9	23·6	12·2	15·7	29·4	13·0	19·6	22·4	12·3	23·4	9·2	17·2	25·5	10·2

(1) Calculated on basis of 100%.

TABLE 11—PHYSICAL AND CHEMICAL ANALYSIS OF REPRESENTATIVE SOIL PROFILES—*Continued*

Soil Type:	Cornwallis Gravelly Sandy Loam (Orchard)					Canning Sand (Virgin Profile)					Canning Sandy Loam (Orchard)				
Horizon of Profile:	A	A_2	B_1	B_2	C	A	A_2	B_1	B_2	C	A	A_2	B_1	B_2	C
Analysis of Whole Soil															
Depth in inches	0″–8″	8″–11″	11″–26″	26″–44″		0″–2″	2″–6″	6″–16″	16″–34″		0″–10″	10″–17″	17″–29″	29″–39″	
% Coarse and fine gravel	27	28	25	26	27	3	2	12	9	11	13	4	8	6	12
% Total sand(1)(1·0-0·05mm)	71	74	72	71	69	83	87	89	95	98	73	72	81	80	83
% Silt(1) (0·05–0·005 mm)	18	18	16	18	21	13	12	9	2	1	12	10	12	12	11
% Total clay(1) (0·005–0·00 mm)	10	9	10	11	8	4	1	2	3	1	13	9	7	7	5
% Fine clay (0·002–0·00 mm)	6	7	7	7	5	3	1	2	1	0	9	7	4	4	3
% Water	1·5	0·4	1·8	1·1	0·8	1·6	0·1	2·0	1·1	0·5	1·1	0·3	0·6	0·9	0·4
% Loss on ignition	5·2	1·1	3·2	2·1	1·7	14·2	0·6	3·0	1·4	0·7	5·2	1·4	1·4	0·9	0·9
pH	5·6	5·1	5·3	5·0	4·9	5·0	4·8	4·8	4·8	4·8	4·5	—	5	4·9	5
Lime requirement (tons $CaCO_3$ per acre)	2·7	1·3	2·6	3·1	3·2	4·2	1·4	2·1	2·1	1·7	4·1	2·6	2·2	2	2·4
Available P_2O_5 (lb. per acre)	57	26	21	27	31	120	62	50	28	40	79	69	32	23	35
% Total P_2O_5	0·10	0·03	0·06	0·08	0·05	0·12	0·03	0·09	0·04	—	0·13	—	0·04	0·03	—
% Total nitrogen	0·14	0·02	0·035	0·04	—	0·22	0·01	0·03	0·01	0·01	0·13	0·02	0·01	0·01	0·01
% Organic carbon	1·68	0·25	0·54	0·34	—	6·9	0·15	0·62	0·42	—	2·3	0·56	0·27	0·14	—
C/N Ratio	12·0	12·5	15·5	8·5	—	31·4	15·0	20·6	42·0	—	17·7	28·0	27·0	46·6	—
m.e. Exch. H	3·7	1·6	3·7	3·6	3·5	9·0	1·6	3·1	2·8	1·8	4·8	—	2·5	1·9	1·6
m.e. Exch. Ca	4·6	2·1	1·3	1·0	0·99	6·1	1·36	1·16	1·24	1·40	2·3	—	0·91	1·07	1·00
m.e. Exch. Mg	0·46	0·38	0·29	0·37	0·39	1·08	0·04	0·04	0·05	0·04	0·44	—	0·24	0·50	0·56
m.e. Exch. K	0·59	0·14	0·24	0·18	0·16	0·59	0·02	0·05	0·15	0·10	0·35	—	0·19	0·15	0·21
% Base saturation	60·4	62·0	33·1	30·3	30·4	46·3	47·0	28·9	38·5	46·1	39·1	—	37·5	47·5	52·5
Clay Fraction only—															
% SiO_2	41·9	56·8	42·6	45·7	47·0	23·3	68·4	34·2	45·2	50·7	38·5	—	42·5	47·0	48·0
% Fe_2O_3	7·0	3·1	6·6	7·1	7·7	4·4	2·8	8·0	7·2	6·8	6·8	—	8·0	7·8	7·9
% Al_2O_3	18·2	23·0	22·6	21·1	21·5	9·1	17·6	26·7	26·4	23·8	17·4	—	23·0	19·6	23·1
SiO_2/Al_2O_3	3·9	4·2	3·2	3·6	3·7	4·1	6·6	2·3	2·2	3·6	3·9	—	3·0	4·0	3·6
SiO_2/R_2O_3	3·1	3·9	2·7	3·2	3·0	3·2	5·9	1·9	2·5	3·1	3·1	—	2·5	3·2	3·0
% Loss on ignition	19·5	11·1	15·3	14·2	11·2	49·3	8·0	20·0	17·9	11·4	27·7	—	21·3	14·0	10·5

(1) Calculated on basis of 100%.

TABLE 11.—PHYSICAL AND CHEMICAL ANALYSIS OF REPRESENTATIVE SOIL PROFILES—(*Continued*)

Soil Type:	Avonport Sandy Loam (Uncultivated)					Gaspereau Sandy Loam (Uncultivated)				Nictaux Sand (Virgin)				
Horizon of Profile:	A	A_2	B_1	B_2	C	A	A_2	B	C	A	A_2	B_1	B_2	C
Analysis of Whole Soil														
Depth in inches	0″-6″	6″-10″	10″-18″	18″-38″	—	0″-8″	8″-12″	12″-20″	—	0″-2″	2″-8″	8″-16″	16″-24″	—
% Coarse and fine gravel	10	10	15	4	13	21	26	37	72	15	18	28	24	10
% Total sand(1) (1·0–0·05 mm)	73	74	84	84	84	62	75	75	93	81	84	84	90	94
% Silt(1) (0·05–0·005 mm)	19	20	8	9	11	23	15	16	15	16	12	10	5	4
% Total clay(1) (0·005–0·00 mm)	6	5	7	5	4	13	10	9	2	3	4	6	5	2
% Fine clay (0·002–0·00 mm)	5	4	6	4	3	10	7	7	2	2	2	5	5	1
% Water	1·4	0·2	1·6	2	0·6	0·7	0·5	3·8	1·0	2·0	1·5	—	—	—
% Loss on ignition	4·8	1·1	2·5	3	1·4	10·2	2·2	7·7	1·8	13·4	0·2	—	—	—
pH	5·3	5·2	5·3	5·2	5·2	5·0	4·7	4·5	4·9	4·6	4·4	5·2	5·1	5·2
Lime requirement (tons $CaCO_3$ per acre)	2·8	1·4	1·4	1·4	1·0	3·9	3·5	3·5	1·4	6·7	1·4	1·4	1·4	1·0
Available P_2O_5 (lb. per acre)	18	18	13	13	18	32	22	24	34	23	23	14	14	28
% Total P_2O_5	0·04	0·04	0·04	0·05	0·05	0·08	0·04	0·07	0·06	—	—	—	—	—
% Total nitrogen	0·12	0·02	0·02	0·03	0·01	0·2	0·03	0·04	0·02	0·24	0·04	—	—	—
% Organic carbon	2·2	0·38	0·46	0·66	—	4·9	0·84	1·0	—	—	0·18	0·33	—	—
C/N Ratio	18·3	19·0	23·0	22·0	—	24·8	28·0	25·0	—	--	4·5	—	—	—
m.e. Exch. H	5·3	2·6	3·4	3·6	2·2	7·7	4·6	7·4	2·5	8·9	0·8	2·2	1·4	1·2
m.e. Exch. Ca	2·68	0·96	1·08	1·32	1·00	3·4	1·0	0·8	0·6	2·2	0·7	0·9	0·6	0·8
m.e. Exch. Mg	0·8	0·36	0·32	0·20	0·24	1·72	0·56	0·56	0·40	0·44	0	0·38	0·22	0·16
m.e. Exch. K	0·53	0·16	0·18	0·18	0·29	0·67	0·15	0·20	0·15	0·08	0·02	0·09	0·05	—
% Base saturation	43·1	36·2	31·7	32·0	41·0	42·9	27·09	17·4	31·5	23·4	47·3	38·3	38·3	—
Clay Fraction only:														
% SiO_2	42·9	57·1	42·0	31·0	44·1	43·1	57·0	32·9	35·3	30·3	63·2	38·8	37·5	36·8
% Fe_2O_3	4·5	2·4	6·9	5·8	7·2	7·6	4·4	13·2	10·8	5·0	3·4	9·6	10·6	9·9
% Al_2O3	18·5	19·3	25·1	31·2	23·8	12·8	21·2	23·8	26·1	10·7	24·1	26·1	27·1	23·1
SiO_2/Al_2O_3	3·9	5·0	2·8	1·7	3·2	5·7	4·7	2·3	2·3	4·8	6·5	2·5	2·3	2·8
SiO_2/R_2O_3	3·4	4·6	2·3	1·5	2·6	4·1	4·1	1·7	1·8	3·7	5·9	2·1	1·8	2·2
% Loss on ignition	25·7	12·8	20·5	30·0	15·6	24·0	13·6	27·3	24·0	48·9	7·3	19·1	20·3	19·8

(1) Calculated on basis of 100%.

TABLE 11.—PHYSICAL AND CHEMICAL ANALYSIS OF REPRESENTATIVE SOIL PROFILES—*(Continued)*

Soil Type:	Nictaux Sandy Loam (Uncultivated)					Nictaux Sand (Orchard)					Nictaux Gravelly Sandy Loam (Uncultivated)			
Horizon of Profile:	A	A_2	B_1	B_2	C	A	A_2	B_1	B_2	C	A	A_2	B	C
Analysis of Whole Soil														
Depth in inches	0″-5″	5″-8″	8″-19″	19″-30″	—	0″-6″	6″-10″	10″-19″	19″-31″	—	0″-8″	8″-13″	13″-22″	—
% Coarse and fine gravel	14	10	18	16	16	8	5	9	6	14	40	24	48	50
% Total sand(1) (1·0-0·05 mm)	71	82	90	91	96	84	88	88	89	93	88	56	94	92
% Silt(1) (0·05-0·005 mm)	15	12	4	5	2	11	8	7	7	3	10	39	2	4
% Total clay(1) (0·005-0·00 mm)	6	6	6	4	2	4	3	4	4	4	2	5	4	4
% Fine clay (0·002-0·00 mm)	4	3	6	4	2	3	2	3	3	3	2	4	1	4
% Water	—	—	—	—	—	0·9	0·02	0·8	0·9	0·2	0·9	1·6	—	—
% Loss on ignition	1·6	0·3	—	—	—	3·1	1·0	1·8	3·2	0·8	8·0	6·5	—	—
pH	5·6	4·9	5·1	5·7	6·2	5·4	5·2	5·4	5·5	5·5	57·	6·1	6·9	6·8
Lime requirement (tons $CaCO_3$ per acre)	1·4	1·4	1·4	1·4	1·0	2·1	1·5	1·4	1·4	1·2	2·8	2·5	1·0	1·0
Available P_2O_5 (lb. per acre)	50	46	37	56	55	80	25	20	24	30	5·0	5·0	9·0	9·0
% Total P_2O_5	—	—	—	—	—	0·09	0·02	0·06	0·03	0·06	—	—	—	—
% Total nitrogen	0·06	—	—	—	—	0·15	0·05	0·01	0·03	0·008	0·06	0·09	—	—
% Organic carbon	0·92	—	0·44	—	—	1·26	0·36	0·34	0·36	0·008	3·41	1·68	0·24	—
C/N Ratio	15·3	—	—	—	—	8·4	7·2	34·0	10·0	1·0	56·8	18·6	—	—
m.e. Exch. H	1·4	0·8	1·7	0·1	1·1	2·9	1·6	2·1	1·5	1·5	6·5	4·6	1·0	2·3
m.e. Exch. Ca	1·5	0·92	0·88	0·68	0·6	2·06	1·07	0·99	1·07	0·69	1·6	1·2	0·8	0·9
m.e. Exch. Mg	0·32	0·08	0·12	0·2	0·16	0·29	0·19	0·17	0·17	0·24	0·3	0·24	0·2	0·3
m.e. Exch. K	0·16	0·11	0·06	0·06	0·08	0·2	0·11	0·09	0·08	0·07	0·46	0·13	0·12	0·15
% Base saturation	58·5	58·1	38·4	90·3	43·3	46·7	46·1	37·3	46·8	40·0	26·6	25·4	52·8	37·0
Clay Fraction only:														
% SiO_2	50	60·2	37·4	30·6	37·6	34·5	51·9	30·6	33·9	44·6	37·7	41·6	35·9	31·4
% Fe_2O_3	8·3	4·5	13·0	12·3	24·5	8·2	6·1	8·8	10·8	11·1	8·9	13·9	15·4	15·9
% Al_2O_3	15·8	17·8	23·2	28·4	18·0	20·6	19·4	23·1	25·9	26·6	19·4	18·1	20·5	20·5
SiO_2/Al_2O_3	5·3	5·7	2·7	1·8	3·6	2·8	4·9	2·2	2·2	2·8	3·3	4·9	3·0	2·6
SiO_2/R_2O_3	4·0	4·9	2·0	1·4	1·9	2·2	3·7	1·8	1·7	2·2	2·5	2·6	2·0	1·7
% Loss on ignition	19·3	6·1	21·9	24·5	19·5	29·9	17·7	30·1	30·3	14·5	28·9	21·2	23·1	27·2

(1) Calculated on basis of 100%.

TABLE 11.—PHYSICAL AND CHEMICAL ANALYSIS OF REPRESENTATIVE SOIL PROFILES—(*Continued*)

Soil Type:	Prospect Sandy Loam (Uncultivated)			Torbrook Sandy Loam (Virgin)					Fash Clay (Virgin—2nd growth bush)			
Horizon of Profile:	A	B	C	A	A_2	B_1	B_2	C	A	A_2	B	C
Analysis of Whole Soil												
Depth in inches	0″-7″	7″-19″	—	0″-6″	6″-9″	9″-23″	23″-33″	—	0″-4″	4″-10″	10″-30″	—
% Coarse and fine gravel	56	68	91	28	41	73	73	78	18	23	—	—
% Total sand(1) (1·0-0·05 mm)	66	96	98	76	77	64	95	94	29	24	17	13
% Silt(1) (0·05-0·005 mm)	28	3	1	16	17	26	2·5	3	32	32	24	26
% Total clay(1) (0·005-0·00 mm)	6	1	1	5	6	10	2	3	39	44	59	61
% Fine clay (0·002-0·00 mm)	4	1	1	4	4	8	2	2	33	42	46	59
% Water	3·2	0·08	0·08	1·9	0·25	2·8	0·5	0·35	3·6	2·9	5·1	5·2
% Loss on ignition	9·9	1·9	1·5	13·0	1·1	9·0	1·8	2·0	6·9	5·5	4·6	4·0
pH	5·1	5·5	5·7	5·4	5·2	5·3	5·6	5·6	4·8	4·6	4·8	6·0
Lime requirement (tons $CaCO_3$ per acre)	3·5	0·7	0·8	4·9	2·4	3·5	1·7	1·4	7·8	8·2	6·9	0·7
Available P_2O_5 (lb. per acre)	18	13	13	64	20	28	26	28	50	36	41	146
% Total P_2O_5	0·12	0·05	0·05	0·13	0·02	0·16	0·07	0·07	0·05	0·05	0·07	0·1
% Total nitrogen	0·25	0·02	0·01	0·22	0·02	0·12	0·02	0·02	0·20	0·04	0·03	—
% Organic carbon	4·5	0·23	—	5·41	0·21	2·67	—	—	3·43	0·6	0·29	—
C/N Ratio	18·0	11·5	—	24·6	10·5	22·2	—	—	17·1	15·0	9·6	—
m.e. Exch. H	7·1	0·09	0·8	2·6	2·9	6·9	1·6	1·3	12·8	15·3	10·1	1·5
m.e. Exch. Ca	1·1	0·48	0·40	7·5	0	0·6	0·2	0·3	3·8	2·0	5·2	13·8
m.e. Exch. Mg	0·52	0·36	0·48	1·3	0	0·3	0	0	1·9	1·6	3·8	7·6
m.e. Exch. K	0·19	0·06	0·11	0·5	—	0·4	0·3	0·1	0·5	0·4	1·8	0·9
% Base saturation	20·3	90·9	55·3	78·0	—	16	24	24	32·6	21·4	51·6	93·7
Clay Fraction only:												
% SiO_2	34·9	30·7	42·7	—	—	—	—	—	43·5	39·8	37·8	48·4
% Fe_2O_3	5·6	3·5	4·8	—	—	—	—	—	4·1	4·9	5·7	5·6
% Al_2O_3	18·9	27·0	19·2	—	—	—	—	—	28·9	22·6	20·3	17·9
SiO_2/Al_2O_3	3'1	1·9	3·8	—	—	—	—	—	2·5	3·0	3·2	4·6
SiO_2/R_2O_3	2·6	1·8	2·2	—	—	—	—	—	2·2	2·6	2·7	3·8
% Loss on ignition	36·5	34·0	26·5	—	—	—	—	—	18·8	18·7	30·7	13·0

(1) Calculated on basis of 100%.

TABLE 11.—PHYSICAL AND CHEMICAL ANALYSIS OF REPRESENTATIVE SOIL PROFILES—(*Concluded*)

Soil Type:	Fash Sandy Clay Loam (Orchard)				Acadia Clay (Dykeland—well drained)				Acadia Clay (Dykeland—poorly drained)		
Horizon of Profile:	A	A_2	B	C	1	2	3	4	1	2	3
Analysis of Whole Soil											
Depth in inches	0″-8″	8″-13″	13″-26″	—	8″	14″	16″	Below 38″	6″	0·12″	16″
% Coarse and fine gravel	38	39	45	27	—	—	—	—	—	—	—
% Total sand(1) (1·0-0·05 mm)	42	47	26	23	22	14	16	14	19	16	13
% Silt(1) (0·05-0·005 mm)	36	32	31	30	50	47	44	45	43	41	41
% Total clay(1) (0·005-0·00 mm)	22	20	32	41	31	35	39	40	40	43	46
% Fine clay (0·002-0·00 mm)	15	12	25	38	27	31	34	35	35	38	35
% Water	1·1	1·6	1·1	1·7	1·4	1·1	0·8	1·2	3·2	2·4	1·1
% Loss on ignition	4·7	4·6	3·1	3·7	5·9	3·8	4·6	4·8	14·3	8·3	5·3
pH	5·6	5·8	5·4	6·0	5·8	7·1	70·	6·7	5·1	4·6	4·3
Lime requirement (tons $CaCO_3$ per acre)	2·1	2·6	1·9	0·9	2·2	0·6	0·3	—	4·8	5·4	4·9
Available P_2O_5 (lb. per acre)	58	39	25	25	49	339	350	282	24	36	46
% Total P_2O_5	0·11	0·04	0·05	—	0·13	0·14	0·15	0·14	—	—	—
% Total nitrogen	0·15	0·12	0·09	—	0·15	0·05	0·06	0·09	0·27	0·17	0·08
% Organic carbon	2·5	1·2	0·19	—	1·6	0·56	0·52	—	5·8	2·4	1·2
C/N Ratio	16·6	10·0	2·1	—	10·8	11·2	8·6	—	17·4	16·6	16·6
m.e. Exch. H	4·9	5·8	3·7	1·8	4·4	1·4	1·5	2·8	9·3	8·4	7·2
m.e. Exch. Ca	7·1	3·8	6·9	12·1	2·6	2·3	2·2	2·3	2·9	2·7	2·3
m.e. Exch. Mg	1·2	0·9	3·4	5·1	5·3	5·4	5·5	5·5	6·4	5·5	4·9
m.e. Exch. K	0·61	0·21	0·25	0·85	0·4	0·8	1·3	1·4	1·2	0·8	1·2
% Base saturation	64·5	45·8	74·0	90·9	60·6	87·4	87·5	80·1	63·3	48·4	43·3
Clay Fraction only:											
% SiO_2	49·5	44·8	49·7	50·1	—	—	—	—	44·3	49·8	—
% Fe_2O_3	5·1	4·7	5·8	6·1	—	—	—	—	4·0	2·4	—
% Al_2O_3	23·1	22·9	22·3	23·8	—	—	—	—	29·3	55·1	—
SiO_2/Al_2O_3	3·7	3·4	3·9	3·6	—	—	—	—	3·5	4·3	—
SiO_2/R_2O_3	3·3	3·0	3·3	3·1	—	—	—	—	3·1	4·0	—
% Loss on ignition	16·3	13·6	11·4	10·6	—	—	—	—	22·1	19·5	—

(1) Calculated on basis of 100%.

TABLE 12.—AVAILABLE PLANT FOOD BY SHORT TESTS, POUNDS PER ACRE, $6\frac{2}{3}$ INCHES DEEP

The symbols used are as follows:—T=trace; L=low; V=very; F=fair; H=high.
In most cases the letters are followed by the approximate number of pounds per acre available.

Soil Type	Horizon	Phosphoric Acid Lb.	Potash Lb.	Lime Lb.	Magnesia Lb.
Pelton loam—Virgin soil	A	L. 25	V.L. 100	F.H. 2,000	F. 50
	B	V.L. 10	— —	T. —	V.L. 10
	C	F. 50	T. —	V.L. 300	L. 25
Canning sandy loam—Virgin soil	A_1	L. 25	V.L. 50	L. 700	F. 40
	A_2	L. 30	V.L. 50	V.L. 400	V.L. 10
	B_1	L. 35	V.L. 50	V.L. 400	L. 25
	B_2	L. 30	V.L. 50	V.L. 400	L. 30
	C	F. 50	V.L. 50	L. 750	F. 50
Kentville sandy loam—Uncultivated	A	L. 30	V.L. 75	F.H. 1,500	F.H. 130
	B	L. 35	V.L. 75	F.H. 1,500	H. 200
	C	F. 50	V.L. 75	F.H. 1,500	H. 200
Woodville sandy loam—Virgin	A_1	V.L. 15	L. 160	L. 750	V.L. 5
	A_2	V.L. 15	V.L. 75	V.L. 400	V.L. 5
	B_1	L. 35	T. —	T. —	V.L. 5
	B_2	L. 25	T. —	T. —	V.L. 5
	C	L. 30	T. —	F.H. 2,000	V.L. 5
Cornwallis sandy loam—Uncultivated	A	V.L. 10	V.L. 75	V.L. 400	L. 25
	B_1	L. 25	V.L. 50	V.L. 300	F. 50
	B_2	L. 25	V.L. 50	V.L. 400	F. 50
	C	F. 45	V.L. 75	V.L. 400	L. 25
Berwick sandy loam—Uncultivated	A_1	L. 30	L. 75	L. 700	L. 30
	A_2	L. 30	V.L. 50	V.L. 400	L. —
	B	F. 45	V.L. 50	V.L. 400	V.L. 25
	C	V.L. 12	V.L. 50	— —	V.L. —
Middleton loam—Uncultivated	A	L. —	F. —	H. —	H. —
	B_1	L. —	L. —	F. —	F. —
	B_2	L. —	V.L. —	F. —	F. —
	C	L. —	V.L. —	F. —	H. —
Wolfville clay loam—Uncultivated	A	H. 100	L. 150	H. 3,000	H. 250
	B	H. 200	L. 150	F. 1,000	H. 250
	C	F.H. 100	L. 150	V.H.4,000	H. 250
Nictaux sandy loam—Virgin	A	L. 25	V.L. 75	L. 700	F. 40
	A_1	L. 35	V.L. 100	V.L. 400	L. 25
	A_2	F. 35	L. 125	V.L. 400	F. 35
	B_1	F. 70	L. 125	V.L. —	L. 25
	B_2	F. 70	L. 125	V.L. —	L. 25
	C	L. 25	— —	V.L. —	T. —
Somerset sandy loam—Uncultivated	A_1	L. 20	V.L. 100	L. 750	F. 40
	A_2	V.L. 10	T. —	V.L. 300	L. 25
	B_1	F. 35	T. —	T. —	V.L. 10
	B_2	L. 30	T. —	T. —	L. 25
	C	L. 25	T. —	V.L. 150	V.L. 10

—	Horizon	Phos. acid	Potash	Lime	Magnesia	Alumina
Berwick sandy loam—Profile of uncultivated bush land	A	F.	H.	L.	F.	H.
	A_2	V.L.	F.	V.L.	F.	H.
	B_1	H.	F.	V.L.	F.	H.
	B_2	H.	L.	V.L.	V.L.	H.
	C_1	L.	L.	L.	L.	H.

TABLE 13.—PERCENTAGE OF THE NUMBER OF SAMPLES CONTAINING DIFFERENT AMOUNTS OF PHOSPHERIC ACID, POTASH, LIME, MAGNESIA AND ALUMINA

pH	Amount	Phos. acid		Potash		Lime		Magnesia		Alumina	
		A	B	A	B	A	B	A	B	A	B
Kentville sandy loam	T	0	0	0	0	5	32	0	0	0	0
A—21 samples 5 to 5·6	VL	0	5	0	9	0	42	0	26	0	0
B—20 samples 4·6 to 5·2	L	0	33	0	14	0	16	16	48	10	0
	F	24	14	10	10	10	5	52	21	21	0
	H	29	24	14	53	45	5	32	5	53	6
	VH	47	24	76	14	40	0	0	0	16	94
Woodville sandy loam											
	T	0	0	0	0	0	41	0	0	0	0
	VL	1	5	2	9	7	25	5	35	0	0
A—93 samples 5 to 5·8	L	5	22	2	21	5	24	18	51	3	0
	F	24	37	4	30	13	6	51	14	22	1
B—90 samples 4·6 to 5·2	H	42	23	18	34	30	3	26	0	48	19
	VH	28	13	74	6	45	1	0	0	27	80
Somerset sandy loam	T	—		—			69	—		—	
	VL	—	3	—	3	3	25	3	33	—	—
A—40 samples 5·2 to 6	L	5	24	—	21	3	3	5	55	2	—
	F	26	33	—	34	22	3	60	12	20	—
B—34 samples 4·6 to 5	H	45	28	25	30	24	—	72	—	68	3
	VH	24	12	75	12	47	—	—	—	10	97
Average of all soil types of this report	T	0	0	0	3	1	30	0	0	0	0
	VL	6	2	1	9	4	26	2	21	0	0
A—543 samples	L	14	14	2	16	5	26	12	44	5	0
	F	23	23	7	26	16	8	50	27	25	1
B—416 samples	H	34	37	20	38	37	4	34	8	47	22
	VH	23	24	70	8	37	6	2	0	23	76

* T=trace; VL=very low; L=low; F=fair; H=high; VH=very high.

TABLE 14.—YIELD OF GRAIN AND HAY FROM PLOTS ON THREE SERIES

Oats—bushels per acre.
Hay—tons, dry matter, per acre.

A—No lime.
B—Lime, 2 tons per acre.

Soil Type	Location	Year	Crop	Check	2-0-10		2-6-10		2-12-10		2-12-0		2-12-6 600 lb. per acre	
					A	B	A	B	A	B	A	B	A	B
Pelton loam	Lakeville	1939	Oats—seeded in 1940	61·2	48·7	.....	53·9	.....	57·7	.....	49·3	.....	55·9	.....
		1940	Grain—on new field	Error made in seeding; no record.										
		1941	Hay—in oats 1939	.....	1·68	.....	1·52	.....	1·32	.....	0·84	.....	1·2	.....
		1941	Hay—in oats 1940	0·88	1·2	2·08	1·2	2·3	1·9	2·4	0·76	1·23	1·2	1·6
Woodville sandy loam	Woodville	1939	Oats	64·5	56	.....	64·6	.....	67·3	.....	71	.....	66·4	.....
		1940	Oats—seeded	35	37	39	44	46	37	44	39	35	46	46
		1941	Hay	0·68	1	1·2	0·72	1·04	1·16	1·3	0·32	0·6	0·8	1·24
Somerset sandy loam	Upper Dyke Village	1939	Oats—not seeded	45·4	45	.....	57·3	.....	51·8	.....	52·4	.....	50	.....
		1940	Oats	52	37	61	72	70	72	79	48	55	57	63
		1941	Hay	1·04	1·3	1·9	1·5	1·9	1·23	1·64	0·72	0·92	1·48	1·84

1939 and 1940 fields in all cases seeded with timothy and clover and half of each plot with limestone in 1940.

TABLE 15.—ACREAGE AND CONDITION OF LAND IN ANNAPOLIS, KINGS AND HANTS COUNTY[1] ALSO IN THE AREA SURVEYED[2] 1911 AND 1931

	Total for 3 counties		Area surveyed
	1911	1931	1931
Total land	2,147,840	2,147,840	
Occupied by farms	1,046,821	910,095	418,132[3]
Improved	294,356	217,628	131,964
Field crops	171,982	156,299	88,381
Pasture	.....	15,447	7,282
Orchards	30,210	38,940	31,761
Market gardens	.....	388	220
Potatoes	8,329	5,958	3,863
Cultivated hay	125,422	117,890	65,847
All grain crops	32,616	24,767	14,370
Root crops	4,661	2,752	1,510
Other crops	6,459	5,801	1,815
Unimproved	751,133	692,467	286,158
Woodland	506,321	467,922	169,210
Natural pasture	.....	207,743	107,916

[1] Dominion Census 1911 and 1931.
[2] Estimated from Census data 1931.
[3] This figure larger than total acreage shown for area surveyed. Difference due to farmers owning lands that extend over the North and South Mountains, thereby outside area surveyed, although in the electoral divisions by which estimated data was compiled.

TABLE 16.—ACREAGE, PRINCIPAL CROPS IN ANNAPOLIS, KINGS AND HANTS COUNTIES[1] AND FOR AREA SURVEYED[2] 1911 AND 1931

	Total three counties		Area Surveyed
	1911	1931	1931
Wheat	1,624	194	50
Barley	1,081	1,382	731
Oats	23,468	20,958	12,701
Rye	201	44	33
Mixed grains	1,644	1,400	855
Buckwheat	3,899	785	
Peas	95	28	888
Beans	490	431	
Hay	125,422	117,890	65,847
Fodder corn	545	377	
Other forage crops	206	4,965	1,849
Potatoes	8,329	5,958	3,863
Turnips	3,629	2,136	
Mangolds	613	501	1,510
Other field roots	419	115	
Apple trees (total number)	1,820,585	1,827,783	
Bearing	690,950	1,489,320	
Non-bearing	1,139,635	338,463	

[1] Dominion Census 1911 and 1931. [2] Estimated, from Census 1931.

TABLE 17.—LIVE STOCK IN ANNAPOLIS, KINGS AND HANTS COUNTIES[1] ALSO ESTIMATED NUMBER IN AREA SURVEYED[2]

	Total for three counties		Area Surveyed
	1911	1931	1931
Horses	13,923	10,299	5,801
Milk cows	21,158	23,528	11,583
Other cattle	32,188	23,463	12,517
Sheep	28,815	22,395	9,651
Swine	18,673	11,462	6,476
Hens and chickens	185,506	306,618	193,211
Other poultry	11,616	7,036	2,762

[1] Dominion Census 1911 an d 1931. [2] Estimated from Census 1931.

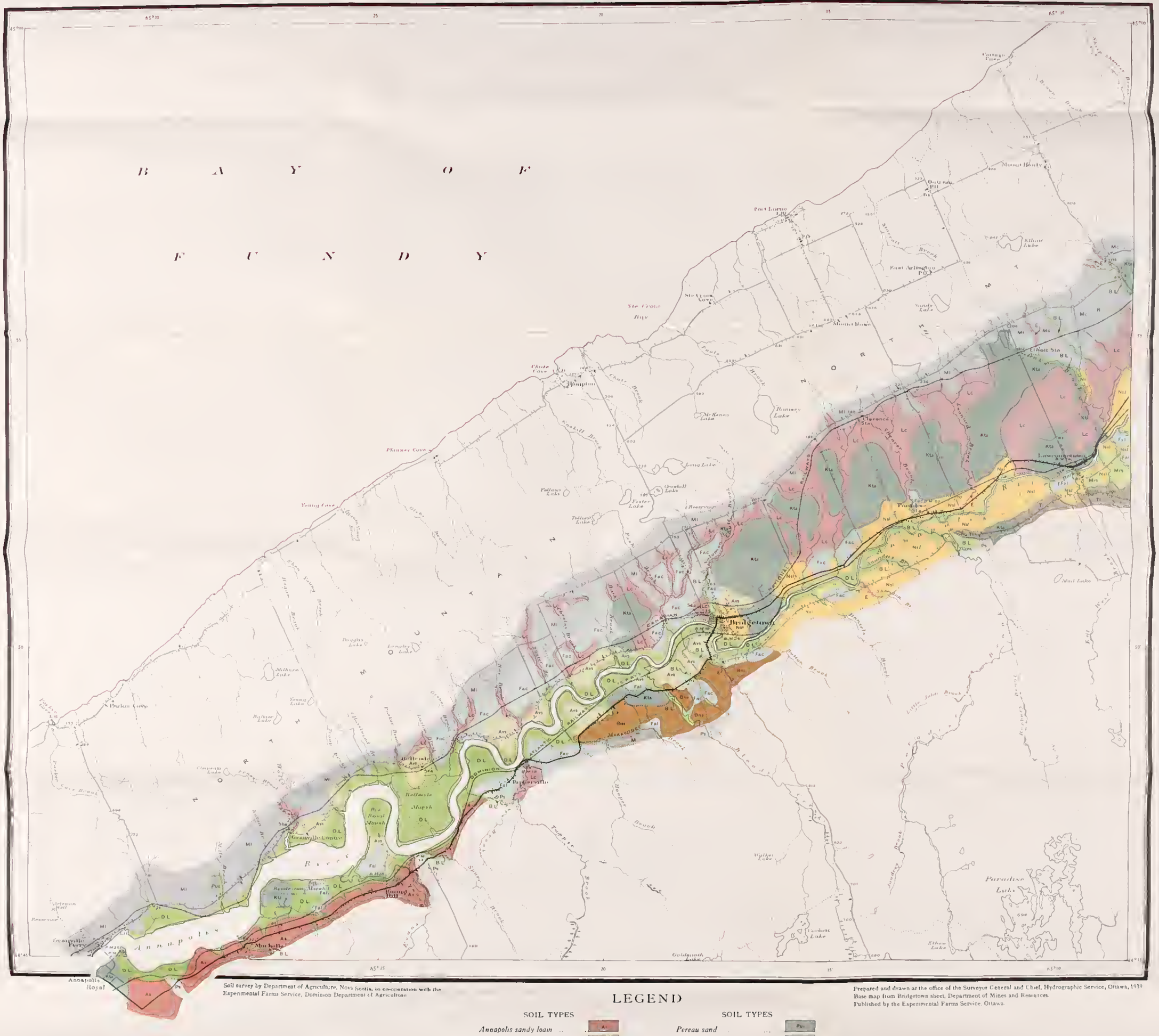
SOIL MAP OF ANNAPOLIS VALLEY

PROVINCE OF NOVA SCOTIA

Scale 1 inch to 1 mile

1 ½ 0 1 2 Miles

SHEET 1


B A Y O F
F U N D Y
Annapolis Royal
Bridgetown
Granville Ferry
Clarence Sta.
Paradise
Middleton
Lawrencetown
Torbrook
Mount Hanley
East Arlington P.O.
Port Lorne
Ste Croix
Ste Croix Cove
Chute Cove
Phinney Cove
Young Cove
Parker Cove
Thornsey Lake
Long Lake
Crockett Lakes
Foster Lake
Pollard Lake
Fellows Lake
Sandy Lake
Kilhaar Lake
Mill Lake
Paradise Lake
Goldsmith Lake
Tupperville
Hollands Marsh
Pine Wood Marsh
Granville Centre
Granville Ferry
Clarence Marsh
Lawrencetown Marsh
Annapolis River
Allain Brook
Chute Brook
Crockett Brook
Stewart Brook
Sandy Brook
Burton Brook
Hoopers Brook
Troop Brook
Trotters Brook
Parker Brook
Young Brook
Phinney Brook
Poole Brook
Mt Hanley Brook
Mt Hanley
Oak Hill
Mt Hanley Lake
Douglas Lake
Mathews Lake
Hayesor Lake
Clements Lake
Higher Lake
Tarbrook Lake
Ethan Lake
Annapolis Royal
Fort Anne
Roseway
Granville Mtn
Mt Hanley
Mt Hanley Lake
Mt Hanley Brook
Mt Hanley Mtn

SOIL MAP OF ANNAPOLIS VALLEY
PROVINCE OF NOVA SCOTIA

Scale 1 inch to 1 mile

1 ½ 0 1 2 Miles

SHEET 2

Soil survey by Department of Agriculture, Nova Scotia, in co-operation with the Experimental Farms Service, Dominion Department of Agriculture.

REFERENCE

- Main roads
- Other roads
- Trails
- Railways
- Marsh
- Soil boundaries
- Height in feet
- Contours

LEGEND

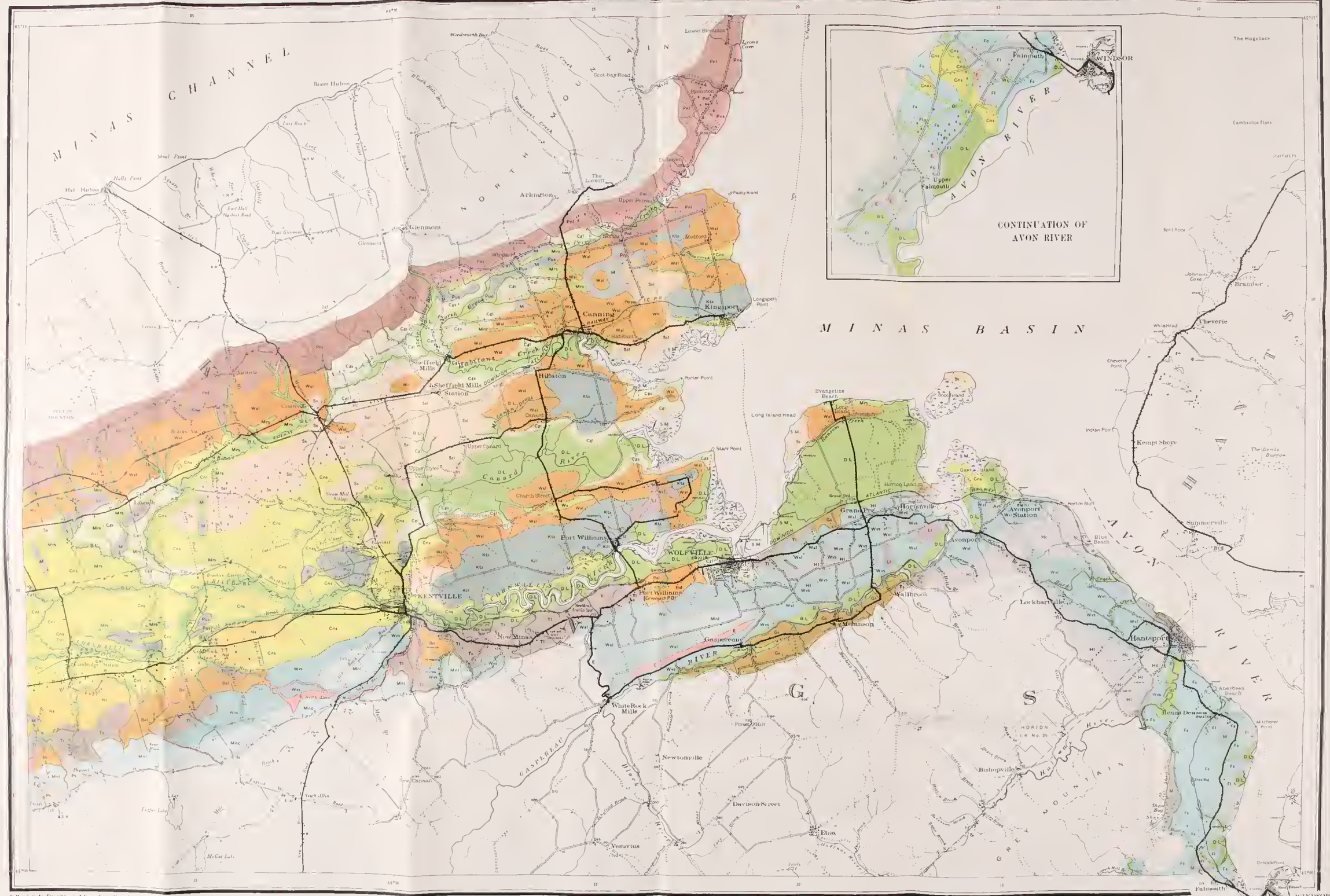
SOIL TYPES		SOIL TYPES		SOIL TYPES		SOIL TYPES	
Avonport sandy loam	Avs	Kentville sandy loam	Kts	Morristown clay loam	Mnc	Torbrook sand	Ts
Berwick sandy loam	Bel	Kentville loam	Kl	Nictaux sand	Ns	Torbrook sandy loam	Tr
Berwick loam	Bl	Lawrencetown loam	Ll	Nictaux sandy loam	Nsl	Wolfville loam	Wol
Canning sand	Cas	Lawrencetown clay loam	Lc	Pelton loam	Pel	Woodville sandy loam	Wsl
Canning sandy loam	Cal	Middleton loam	Ml	Pelton clay loam	Pec	Muck	M or P
Cornwallis sand	Cns	Middleton clay loam	Mc	Perreau sand	Pus	Eroded	E
Cornwallis sandy loam	Cnl	Millar sand	Mrs	Prospect sandy loam	Ps	Bottom land	B.L
Fash loam	Fal	Morristown sandy loam	Mnl	Somerset sand	Se	Gravelly phase	
Fash clay	Fac	Morristown loam	Mnl	Somerset sandy loam	Sol	Rocky phase	

Prepared and drawn at the office of the Surveyor General and Chief, Hydrographic Service, Ottawa, 1930
Base map made from the Bridgetown sheet, Department of Mines and Resources, Ottawa, and the Berwick sheet, Department of National Defence, Ottawa.
Published by the Experimental Farms Service, Ottawa.

SOIL MAP OF ANNAPOLIS VALLEY
PROVINCE OF NOVA SCOTIA

Scale 1 inch to 1 mile

SHEET 3



Soil survey by Department of Agriculture, Nova Scotia, in co-operation with the Experimental Farms Service, Dominion Department of Agriculture

Prepared and drawn at the office of the Surveyor General and Chief, Hydrographic Service, Ottawa, 1939
Base map made from the Wolfville sheet, Department of Mines and Resources, Ottawa, and the Berwick sheet, Department of National Defence, Ottawa.
Published by the Experimental Farms Service, Ottawa.

LEGEND

REFERENCE

- Main roads
- Other roads
- Trails
- Railways
- Marsh
- Soil boundaries
- Height in feet
- Contours
- Depression contours

SOIL TYPES

Avonport sand	Avs
Canning sand	Cas
Canning sandy loam	Cal
Cornwallis sand	Cns
Cornwallis sandy loam	Cnl
Berwick sandy loam	Bel
Falmouth sandy loam	Fs
Falmouth loam	Fl
Falmouth clay loam	Fc
Gaspereau sandy loam	Gs

SOIL TYPES

Hantsport loam	Hl
Hantsport clay loam	Hc
Kentville sandy loam	Kls
Kentville loam	Kll
Lawrencetown clay loam	Lc
Millar sand	Mrs
Morristown loam	Mnl
Morristown clay loam	Mnc
Nictaux sand	Ns
Pelton sandy loam	Pns

SOIL TYPES

Pelton loam	Pnl
Pelton clay loam	Pnc
Prospect sandy loam	Ps
Pereau sand	Pus
Somerset sand	Ss
Somerset sandy loam	Sal
Torbrook sand	Ts
Torbrook sandy loam	Tl
Wolfville sandy loam	Wvs
Wolfville loam	Wvl

SOIL TYPES

Woodville sandy loam	Wsl
Muck or peat	M or P
Bottom land	B L
Dyke land	D L
Eroded	E
Salt marsh	S M
Gravelly phase	G
Rocky phase	R

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